Grand Avenue
Northwest Corridor Study

WORKING PAPER NO. 8

DEVELOPMENT AND EVALUATION OF INVESTMENT OPTIONS

March 7, 2002

Prepared for

MARICOPA ASSOCIATION of GOVERNMENTS

Prepared by

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EXECUTIVE SUMMARY

A full array of options have been developed based upon the needs defined in Working Papers Nos. 6 and 7. The options are grouped into three major categories: (1) Roadway Improvements, (2) Operational and Aesthetic Improvements, and (3) Transit and Multimodal Improvements. The needs are stated and one or more options to meet that need are identified. Some general evaluation of the options is provided.

The options for each category are presented in the table below. The next step in the process is to present these options to the agency/community stakeholders to obtain input on the relative importance of each of the options. This input will aid in ranking the options and selection of those options that will be recommended for further development and implementation.

Options for Improvements to Grand Avenue Northwest Corridor

	Description	Cost*	Comments
1. Roadway Improvements (based on Enhanced Arterial/Limited Expressway Alternative)			
Roadway Option			
A	Widen Grand to six lanes and meet drainage standards	$29m	9.6 miles
B	Add turn lanes to cross streets	$7m	May conflict with pedestrian improvements
Grade Separations – Access to Boswell Hospital			
C or	107th Avenue interchange	$40-$45m	Major property takes; not cost effective
D or	103rd Avenue grade separation	$24m	Significant property takes; no direct access from Grand; local funding required
E	Emergency-only	$7.5m	Hospital needs to be partner; ADOT funding questionable
Grade Separations – Access to Del E. Webb Hospital			
F or	Meeker/Reems interchange	$30m	Major property takes
G	Emergency-only	$6m	Hospital needs to be a partner; ADOT funding questionable; Location Study needed
Grade Separation – Capacity Needs			
H	Bell Road interchange	$40m	Major property takes; property access limitations
Grade Separation – Continuous Routes			
I or	El Mirage/Thompson Ranch Road extend to Olive Avenue	$35m	Requires commitment from City of El Mirage and local government leadership
J or	El Mirage Road (west alignment)	$31m	Requires commitment from City of El Mirage and local government leadership
K	Greenway Road Interchange	$30m	At-grade crossing exists
L	Grand Avenue at BNSF spur	$17m	Limits access to El Mirage; not cost effective
M	Remove seven traffic signals	NA	Major impacts to commercial property and access to some neighborhoods

	Description	Cost*	Comments
N	Eliminate median breaks for left turns	NA	Consider with Option A
O	Limit new access to Grand and remove existing access where feasible	NA	Policy agreement between ADOT and cities/County
2. Operational and Aesthetic Improvements			
A	Provide landscaping on side and median and street lighting	NA	Requires participation by cities/County
B	Evaluate signage especially for elderly	NA	City/County signage should be included in study
C	Place guardrail along drainage channel	NA	Space between road and channel is very limited
D	Extend the ITS "Smart Corridor" to Loop 303	$2.5m	
E	Evaluate signal equipment and signal timing and phasing	NA	Follow-up study by ADOT
F	Evaluate all railroad crossing warning/control devices	NA	Follow-up study by ADOT
G	Evaluate signal timing for pedestrians	NA	Follow-up study by ADOT
Transit Option			
Extend Regional Bus System			
A1	Extend local bus service along Grand		Short-term; cities, County, RPTA
A2	Extend local bus service and add new routes on other arterials		Short-term; cities, County, RPTA
A3	Add on-street bus bays		Short-term; cities, County, RPTA
B	Improve bus stops for user comfort		Short-term; cities, County, RPTA
Restructure Paratransit to Better Meet Travel Needs			
C1	Develop seamless Dial-a-Ride system in Northwest Valley		Short-term; cities, County, RPTA
C2	Study innovative approaches to serving seniors and persons with disabilities		Short- to mid-term; cities, County, MAG, RPTA, others
D	Develop Park-and-Ride capacity near Loop 101 (proposed location near Glendale Avenue/Loop 101)		Short- to mid-term; ADOT, RPTA, cities, MAG
E	Improve bus and dial-a-ride services to meet regional service standards.		Mid term, cities, County, RPTA
F	Develop improved alternatives for local circulation.		Short to mid term, cities, County, RPTA
G	Develop park-and-ride capacity in western portion of corridor (proposed location near Bell/Dysart).		Mid to long term; MAG, RPTA, cities
H	Consider express or high capacity transit (bus rapid transit, light rail, commuter rail) in corridor as extension of regional system.		Long term; MAG, RPTA, BNSF Railroad for commuter rail (MAG Study is under way)

	Description	Cost*	Comments
Pedestrian Option			
Improve Pedestrian Facilities Along Grand Avenue			
A1	Build shared use path on southwest side of Grand		ADOT, County, cities
A2	Provide wider, detached standard walkway on intersecting streets		Cities, County
B	Develop all railroad crossings to a minimum standard, with paved trackway, 8-foot walkways and ADA accessibility		ADOT, cities, County, BNSF Railroad
C	Assess feasibility and neighborhood acceptance of additional gated connections through community walls		County, cities, others (private associations and groups)
D	Minimize channelized right turns and dual left turn lanes that make crossings more difficult for pedestrians		ADOT, cities, County
E	Develop and improve pedestrian connections from the corridor to off-road trails		County, cities
Implement Measures to Reduce the Impact of Existing Development Patterns on Walk Distances			
F1	Provide neighborhood circulator transit to cover excessive walk distances		Cities, County, RPTA
F2	Institute land development standards to make activity centers more pedestrian-friendly		Cities, County
G	Provide more shade for pedestrian comfort		Cities, County, Homeowner Associations
H	Provide buffers between sidewalk and curb		Cities, County
I	Implement measures to make intersection crossings safer and easier, especially for the elderly		ADOT, cities, County
J	Conduct pedestrian counts and neighborhood meetings to determine destinations accessed by using Grand Avenue and intersecting streets		MAG
Options Stemming from MAG Elderly Mobility Initiative			
K1	Consider corridor for a demonstration to try out various pedestrian-friendly techniques		Cities, County, ADOT, MAG
K2	Develop more pedestrian-friendly land use guidelines (see F2 above)		Cities, County
K3	Conduct on-site review of current infrastructure and land use, with results incorporated into the transportation review process		MAG, cities, County

	Description	Cost*	Comments
Bicycle Option			
Improve Riding Conditions for Cyclists Along Grand from SR 101 to Loop 303			
A1	Create edge line buffer zones, using shoulders or 16-foot outside lanes		ADOT
A2	Provide bike lanes along Grand Avenue		ADOT
A3	Provide a 10-foot bike path, buffered from the roadway, along Grand Avenue		ADOT, city, County
B	Design all grade-separated crossings of Grand Avenue and the BNSF Railroad to accommodate bicycles and pedestrians		ADOT
C	Provide bike lanes or edge line buffer zones as part of the El Mirage/Thompson Ranch connector between Paradise Lane in Surprise and Grand Avenue in El Mirage		El Mirage, Surprise
D	Develop the West Valley (New River) Multimodal Transportation Corridor and the West Valley Rivers/Agua Fria Corridor as non-motorized transportation and recreation facilities		MAG, Surprise, County
E	Provide direct connections between the Grand Avenue Corridor and intersecting off-road, non-motorized corridors		Cities, County, MAG
F	Coordinate bikeway planning and development in the corridor with various cities and MCDOT		Cities, County, MAG
G	Provide a continuous, interconnected bicycle network by building facilities recommended in previous studies and plans		Cities, County
H	Conduct and implement the recommendations of a bicycle safety audit of railroad grade crossings		ADOT, cities, County, BNSF Railroad
Electric Cart Option			
A	Design any new vehicular route crossing the Agua Fria River to accommodate carts		Cities, County
B	As the area of Surprise southwest of Grand Avenue builds out, consider the needs of electric cart users in designing any new route connecting this area with Sun City West.		Surprise, County, ADOT
C	Conduct cart crossing counts at Grand Avenue signalized intersections to determine whether special warning signs are needed		MAG, County, cities

	Description	Cost*	Comments
D	Develop a program to educate motorists on their responsibility to safely share the road with slower- or faster-moving vehicles		MAG, ADOT, County, cities
E	Include issues relating to cart access, mobility and safety in the MAG Northwest Area Transportation Study		MAG
F	Assess the feasibility of electric cart operations within off-road transportation corridors		MAG

*Includes right-of-way and engineering costs.

1.0 INTRODUCTION

In order to identify and evaluate a wide range of optional actions for the Grand Avenue Northwest Corridor, three categories of improvements were established:

Roadway Options

Operation and Aesthetic Improvements

Transit and Other Modes

For the most part, improvements in one category are functionally independent of the other categories. As such, options for major roadway improvements can be evaluated independent from transit and other modes as an example. However, in some cases action options in one category may be in conflict with action options in another category. These options will be presented to the Agency/Community Forum and to the public for review and comment. The formulation of the recommendations for the corridor to be included in the final report will consider the agency and public input and the interrelationship among the categories.

The options and concepts presented herein have been developed through a series of public meetings, meetings with local jurisdictions, and agency/community forums. Several of the alternative actions presented in this paper are direct suggestions from the public and agencies. Other actions were identified by the Maricopa Association of Governments (MAG) and consultant study team based on the major issues, goals and policies presented in Working Paper No. 5, the long-term road needs in Working Paper No. 6 and the alternative mode needs in Working Paper No. 7.

The options have been evaluated considering the full range of evaluation factors including environmental effects, cost, cost-effectiveness, community acceptance, implementation responsibilities, right-of-way and property takes, etc. For brevity and clarity, only those factors that are particularly relevant in the evaluation of a particular option are described in this paper.

2.0 ROADWAY OPTIONS

There were three overall corridor alternatives considered for the Grand Avenue Northwest Corridor: the no-build alternative, enhanced arterial/limited expressway alternative, and full expressway alternative. Each of the alternatives is briefly described below.

No-Build – The no-build concept would leave Grand Avenue as it is and would make no additional improvements within the corridor.

Enhanced Arterial/Limited Expressway – Would widen Grand Avenue to a six-lane arterial street between Loop 101 and Loop 303; construct grade separations where warranted and feasible; improve remaining at-grade intersections and provide signal coordination; and consolidate and eliminate some access locations.

Full Expressway – Would construct a full expressway concept with complete access control. A full expressway would have few traffic signals, full access control, and grade separations or interchanges at most cross streets.

Based on input from local agencies and the public at three Agency/Community Forums, a public meeting, and two community outreach meetings requested by community representatives, the enhanced arterial/limited expressway alternative was selected for further refinement and evaluation as part of this study.

The no-build alternative is always an option and is used as a basis for comparison. With increased travel demand in the Grand Avenue Northwest Corridor, the no-build alternative would lead to increasing congestion and delay, and decreasing safety. However, it remains an alternative until a specific funded program of improvements is chosen by the implementing agency.

Based on responses obtained through the public involvement process and the analyses conducted as part of this project, the full expressway alternative for Grand Avenue was eliminated from further study for the following reasons:

- A full expressway would be very expensive to design and build (over $500 million).
- An additional 100 to 150 feet of right-of-way would be needed at interchanges, and some right-of-way would be needed in other portions of the corridor.
- Many businesses and residences would require relocation including a large percentage of the total commercial/retail businesses in El Mirage, Youngtown, Sun City (south of Grand Avenue), and in Surprise on the southwest side of Grand. Access to many remaining businesses would be altered or reduced.
- Traffic volumes on Grand Avenue would increase up to 150,000 vehicles per day.
- Faster speeds and more truck traffic would be encouraged.
- Railroad grade separations would not necessarily be provided.
- Noise within the corridor would increase.
- The larger highway may increase the barrier effect of crossing Grand Avenue.
- Several new traffic signals have been installed or approved for installation on Grand Avenue which will make it extremely difficult and very disruptive to convert the roadway into an expressway. Of the 19 signals, at least half would have to be removed to approach expressway standards.
- Between I-17 and Loop 101, a series of grade separations are programmed for construction which would continue traffic signals on Grand Avenue at most locations, which is not consistent with a full expressway.

- The pavement may need to be replaced to accommodate the higher traffic loads.
- SR 303L is being upgraded to relieve Grand Avenue of some traffic and thereby reducing the need for a full expressway.

The enhanced arterial/limited expressway alternative was refined based on comments received to date. The alternative is comprised of several components based upon the needs identified in Working Paper No. 6, Long Term Roadway Needs. For each component, one or more options were identified and presented at the agency/community forums. A questionnaire on the options was provided to participants at the February 26, 2001 agency/community forum. Depending upon input from the Agency/Community Forum and public, available funding sources, and technical issues, not all of the potential improvements identified and presented below may be recommended for implementation in the final report.

The concepts for improvements have been grouped into the following categories: (1) widen Grand Avenue; (2) add turn lanes on cross streets; (3) grade separations; (4) continuous arterial routes; and (5) access management along Grand. Options in each of these four categories are identified and evaluated below.

General cost estimates for construction and right-of-way are provided for each option. The estimates are based upon 2000 unit prices and have not been inflated for a future year of construction.

2.1 Widen Grand Avenue to Six-Through Lanes

Need: One of the major needs identified for the corridor is the increasing traffic congestion that is aggravated by the inconsistent number of lanes provided on Grand Avenue. Widening Grand Avenue would address these deficiencies.

Option A: Grand Avenue would be widened to three 12-foot travel lanes in each direction from Loop 101 to Loop 303. A raised median 12 to 18 feet wide would separate the directions of travel. From Loop 303 to the Agua Fria River, the widening would be in the median. Between the Agua Fria and New rivers, the widening would be on the outside. A 2-foot inside shoulder or "shy distance" would be provided for curbed medians. A 5-foot outside shoulder would be provided on curbed sections and 10-foot outside shoulders on non-curbed sections. Some reductions in width may be needed where there is limited right-of-way available. Exhibits 2.1, 2.2, 2.3, and 2.4 illustrate proposed typical sections along the corridor. Widening Grand Avenue requires widening/reconstructing the existing bridge over the New River. The Agua Fria River Bridge would not need widening. Dual left-turns lanes in the northwest-bound and southeast-bound directions should be provided on Grand Avenue at the following intersections: 99th Avenue, 107th Avenue, Thunderbird/Thompson Ranch, Bell, and Meeker/Reems. Due to limited right-of-way near 107th Avenue (particularly on the railroad side), the ability to provide dual left-turn lanes is questionable and should be evaluated further. As shown in Figure 2.2, some widening will be needed in the outside northwest of the Agua Fria River to accommodate dual left-turn lanes.

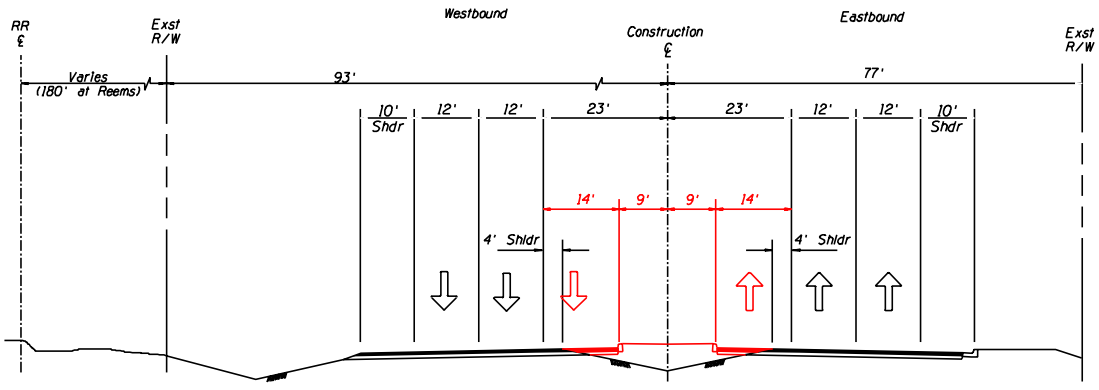

EXHIBIT 2.1
REEMS RD to BELL RD
PROPOSED TYPICAL SECTION
Between Intersections
(looking SE)

GRAND AVENUE
NORTHWEST CORRIDOR STUDY

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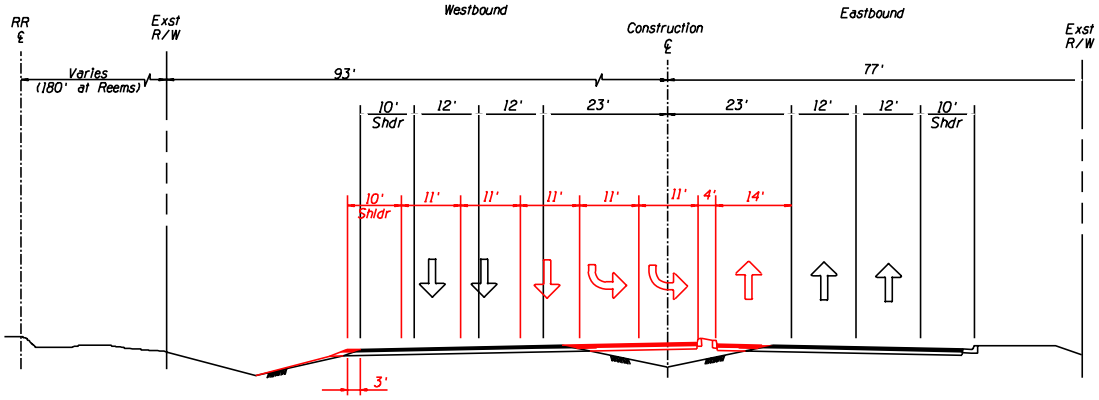

EXHIBIT 2.2
REEMS RD to BELL RD
PROPOSED TYPICAL SECTION
w/ Dual Left Turn Lanes
(looking SE)

GRAND AVENUE
NORTHWEST CORRIDOR STUDY

MARICOPA ASSOCIATION of GOVERNMENTS

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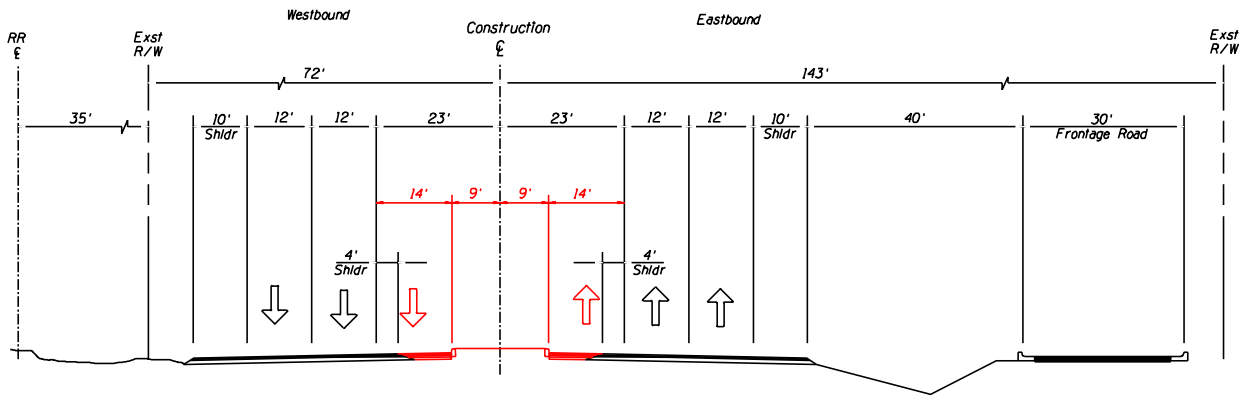

EXHIBIT 2.3
DYSART RD to THUNDERBIRD RD
PROPOSED TYPICAL SECTION
Between Intersections
(Looking SE)

GRAND AVENUE
NORTHWEST CORRIDOR STUDY

MARICOPA ASSOCIATION of GOVERNMENTS

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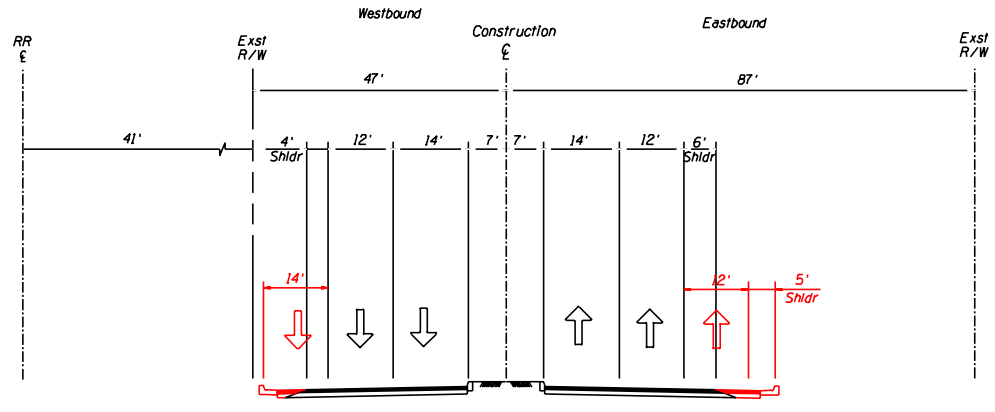

EXHIBIT 2.4
EAST and WEST OF 107th AVE
PROPOSED TYPICAL SECTION
(Looking SE)

GRAND AVENUE
NORTHWEST CORRIDOR STUDY

MARICOPA ASSOCIATION of GOVERNMENTS

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For the most part, the widening of Grand Avenue can be accomplished within existing right-of-way. Areas where additional right-of-way might be needed are near 111th and 107th Avenues. Out of the 10.8 miles between Loop 101 and Loop 303, 9.6 miles need to be widened. The roadway could be widened in stages to minimize the impacts to access and travel within the corridor. Widening Grand Avenue would increase the distance required to cross Grand Avenue making it more difficult to cross for pedestrians, bicycles and golf carts. The estimated cost to widen Grand Avenue including the bridge over the New River is in the range of $29 million.

Roadway drainage on Grand Avenue throughout the corridor should be evaluated. Stormwater ponding on the roadway was observed west of 99th Avenue. Because of the limited right-of-way, curb and gutter may need to be included on both sides of the roadway and an underground storm drain constructed in the 113th to 99th Avenue section.

Responses from the questionnaires were in strong support of widening Grand Avenue. The widening of Grand and addition of dual left-turn lanes will greatly improve traffic operations within the corridor. The negative impacts associated with this improvement are primarily the increase in pavement width that pedestrians, bicycles and golf carts would have to traverse to cross Grand Avenue.

2.2 Add Turn Lanes on Cross Streets

Need: ***The cross streets that intersect Grand Avenue are also congested. Additional through and turn lanes on the cross streets at the signalized intersections would improve traffic operations and increase capacity. The additional through and turn lanes on the cross streets are proposed to provide level of service (LOS) D or better for year 2025 design volumes. Some turn lanes are proposed to balance opposing traffic lanes that are needed based on the design volumes***.

Option B: Potential lane additions are as follows:

99th Avenue

Add southbound (SB) and northbound (NB) left-turn lanes to create dual left-turn lanes on 99th Avenue.

107th Avenue

Add SB and NB left-turn lanes to create dual left-turn lanes on 107th Avenue.

Thunderbird Road/Thompson Ranch Road

Add SB left-turn lane to create dual left-turn lanes on Thunderbird Road.

Add NB left-turn lane to create dual left-turn lanes on Thompson Ranch Road.

Dysart Road

Widen Dysart Road to provide two through lanes through the intersection in each direction.

Add a NB and SB left-turn lane to create dual left-turn lanes on Dysart Road.

Bell Road

Widen WB Bell to three through lanes through the intersection.

Meeker Boulevard/Reems Road

Add a SB left-turn lane to create dual left-turn lanes on Meeker Boulevard.

Add a NB left-turn to create dual left-turn lanes on Reems Road.

Widening Grand Avenue and providing cross street improvement as described above would allow the Grand Avenue intersections to accommodate the 2025 design volumes at LOS D or better with the exception of the intersection of Bell Road and Grand Avenue. These improvements would eliminate many of the operational problems along Grand Avenue. The estimated cost to provide the cross street improvements is $7 million. The widening and turn lanes could be accomplished with minimal additional right-of-way and impact to businesses and residences. Traffic restrictions during construction would not severely impact travel or access within the corridor. The cross street improvements provide significant operational improvements with few impacts.

2.3 Provide Grade Separations at Selected Intersections

In response to citizen concerns about the barrier effect created by Grand Avenue and the railroad tracks to vehicles, emergency vehicles, pedestrians and bicycles attempting to cross Grand Avenue, five locations along Grand Avenue were evaluated as possible locations for grade separations. A grade separation is where one road is bridged over another road so that the through traffic on the two roads do not intersect. The first group of grade separation options would provide improved access to the Boswell Memorial Hospital and the Del E. Webb Memorial Hospital. The second group would provide needed capacity improvements. The third group would help establish a more continuous north-south route across the Grand Avenue corridor. The final location evaluated grade separating the railroad spur with Grand Avenue.

2.3.1 Access to Hospitals

Need: ***Although no documentation has been presented of a life being lost because of access to the hospitals being blocked by a train, there is a general concern from the public that it could occur. On an average day, 12 trains travel between Loop 101 and Loop 303. When a train crosses an intersection, it blocks the intersection for up to 210 seconds (based on a train of maximum length = 6,000 feet). The two hospital locations were addressed separately, and several options were considered at each location***.

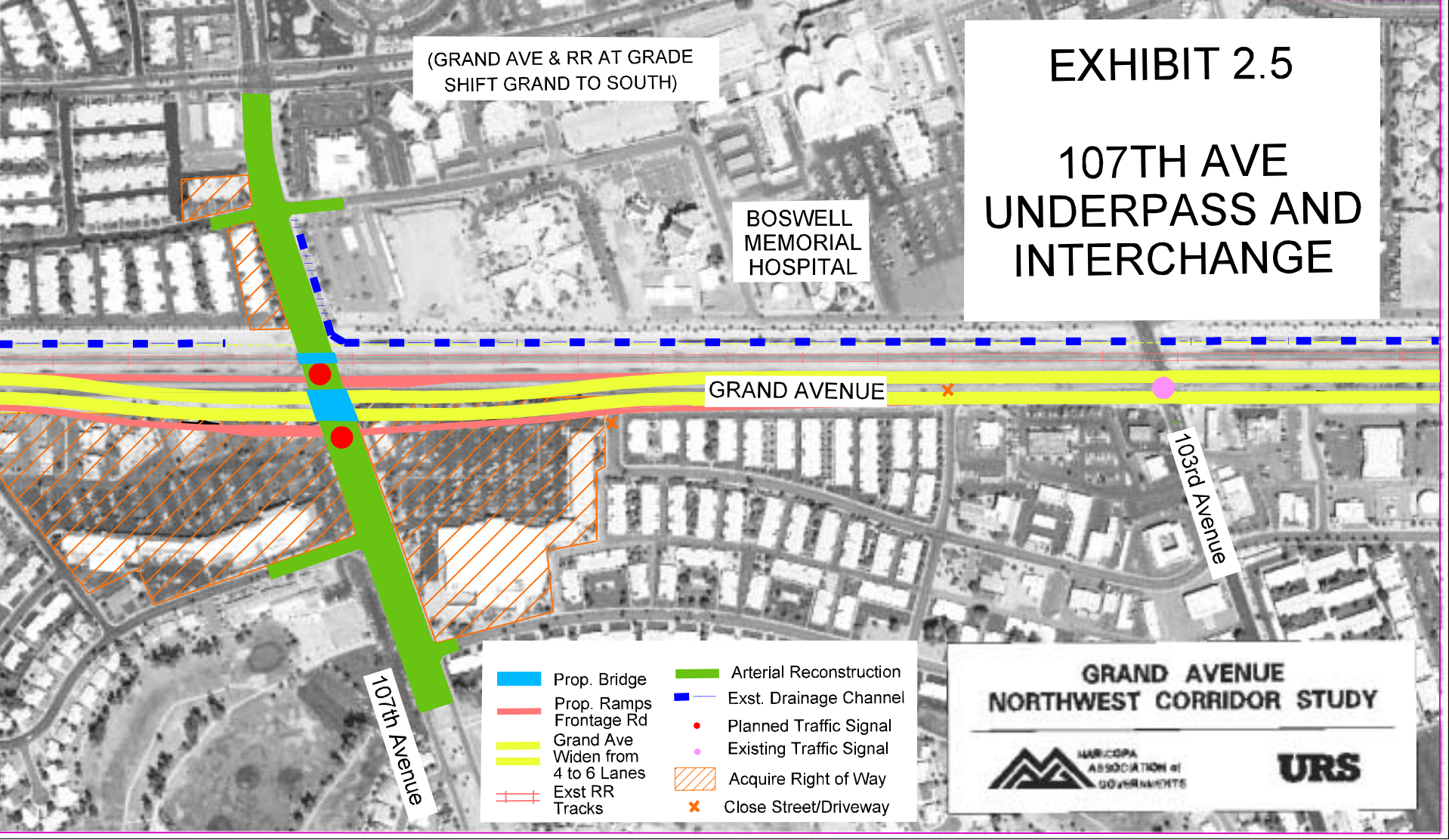
The **Boswell Memorial Hospital** is located on the northeast side of Grand Avenue and the railroad between 107th Avenue and 103rd Avenue. Three alternative grade separations were evaluated to improve access to the hospital: at 107th Avenue, at 103rd Avenue and direct access to the hospital between these two streets.

Option C: **107th Avenue:** An underpass for 107th Avenue below Grand Avenue and the BNSF Railroad, both of which would stay at-grade, would be constructed. The grade separation with the railroad would eliminate the potential of emergency vehicles traveling to and from Boswell Memorial Hospital being blocked by a train. This underpass would also enhance pedestrian, bicycle, golf cart, and general motor traffic movement across the railroad and Grand Avenue. Either a single point urban interchange (SPUI) or a diamond interchange could be constructed at this location.

For either interchange, the narrow existing right-of-way would require Grand Avenue to be realigned to the southwest to make room for the northwest-bound on/off-ramps abutting the railroad right-of-way. Refer to Exhibit 2.5. This interchange would provide direct access to Boswell Memorial Hospital. The existing crossroad skew is approximately 18 degrees at this location. Access to 107th Avenue from adjacent businesses would be disconnected through the depressed section (approximately 1,000 feet on either side of Grand Avenue). Approximately 91 feet of new right-of-way is needed. Refer to Exhibit 2.6. The interchange would likely require the relocation of shopping centers on both sides of 107th Avenue, south of Grand Avenue. There are few other nearby shopping centers for the residents in this area. A temporary detour track for the railroad would need to be constructed to build the underpass.

The cost of right-of-way and construction of an interchange would be between $40 and $45 million and would severely impact businesses and residences. Other than providing a grade separation with the railroad, the interchange is not needed to accommodate traffic design volumes. Therefore, an interchange at this location seems to have more impacts than benefits and is not a cost-effective solution.

Option D: **103rd Avenue:** A grade separation at 103rd Avenue would be an alternative to one at 107th Avenue with the same purpose of providing a grade separation with the railroad to assist emergency vehicles and the movement of pedestrians, bicycles, golf carts, and general motor traffic across the railroad and Grand Avenue. 103rd Avenue would be an underpass below Grand Avenue and the BNSF Railroad, which would both stay at-grade. Refer to Exhibit 2.7. Access to 103rd Avenue from adjacent businesses would be disconnected through the depressed section (approximately 1,000 feet on either side of Grand Avenue). This option is presented as a grade separation, not an interchange. As such, it would be much better for motorized and non-motorized traffic across Grand and the railroad. If ramps were to be added, they would result in additional impacts to businesses fronting Grand Avenue. A shoofly (detour) for the railroad would need to be constructed to build the underpass.


(GRAND AVE & RR AT GRADE
SHIFT GRAND TO SOUTH)
BOSWELL
MEMORIAL
HOSPITAL
GRAND AVENUE
103rd Avenue
107th Avenue
Prop. Bridge
Prop. Ramps
Frontage Rd
Grand Ave
Widen from
4 to 6 Lanes
Exst RR
Tracks
Arterial Reconstruction
Exst. Drainage Channel
Planned Traffic Signal
Existing Traffic Signal
Acquire Right of Way
Close Street/Driveway
EXHIBIT 2.5
107TH AVE
UNDERPASS AND
INTERCHANGE
GRAND AVENUE
NORTHWEST CORRIDOR STUDY
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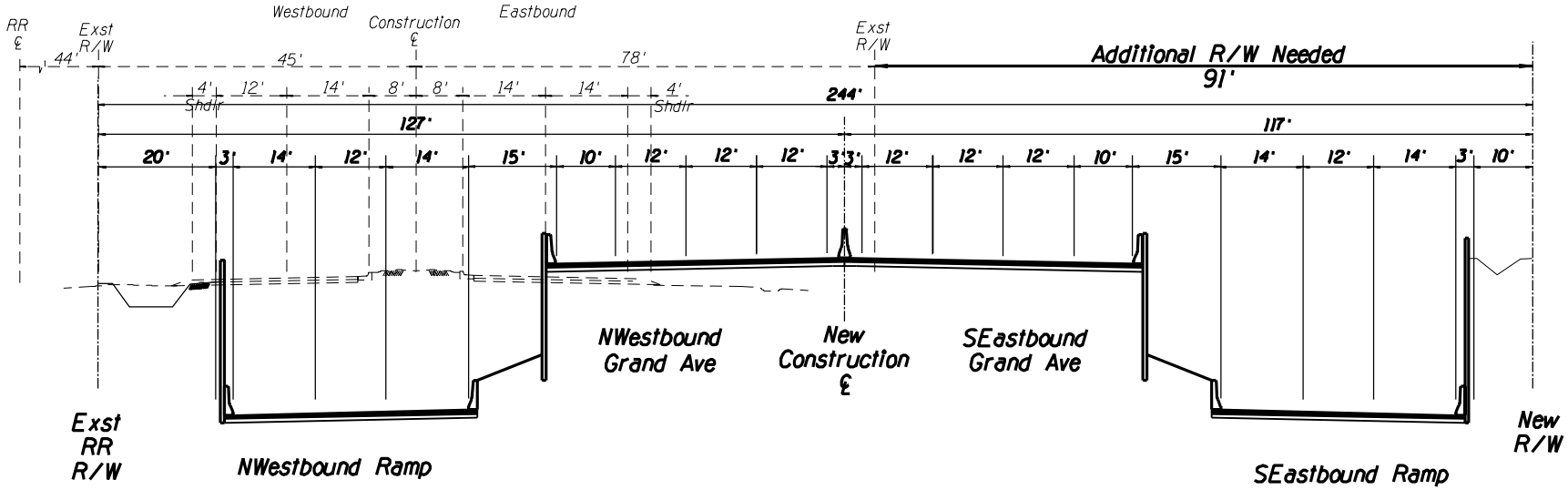

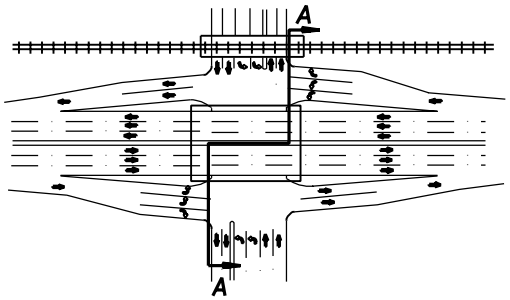

PROPOSED TIGHT SPUI/DIAMOND
PLAN VIEW

EXHIBIT 2.6
107th AVENUE UNDERPASS to GRAND AVENUE
CROSS SECTION A-A
(looking SE)

GRAND AVENUE
NORTHWEST CORRIDOR STUDY

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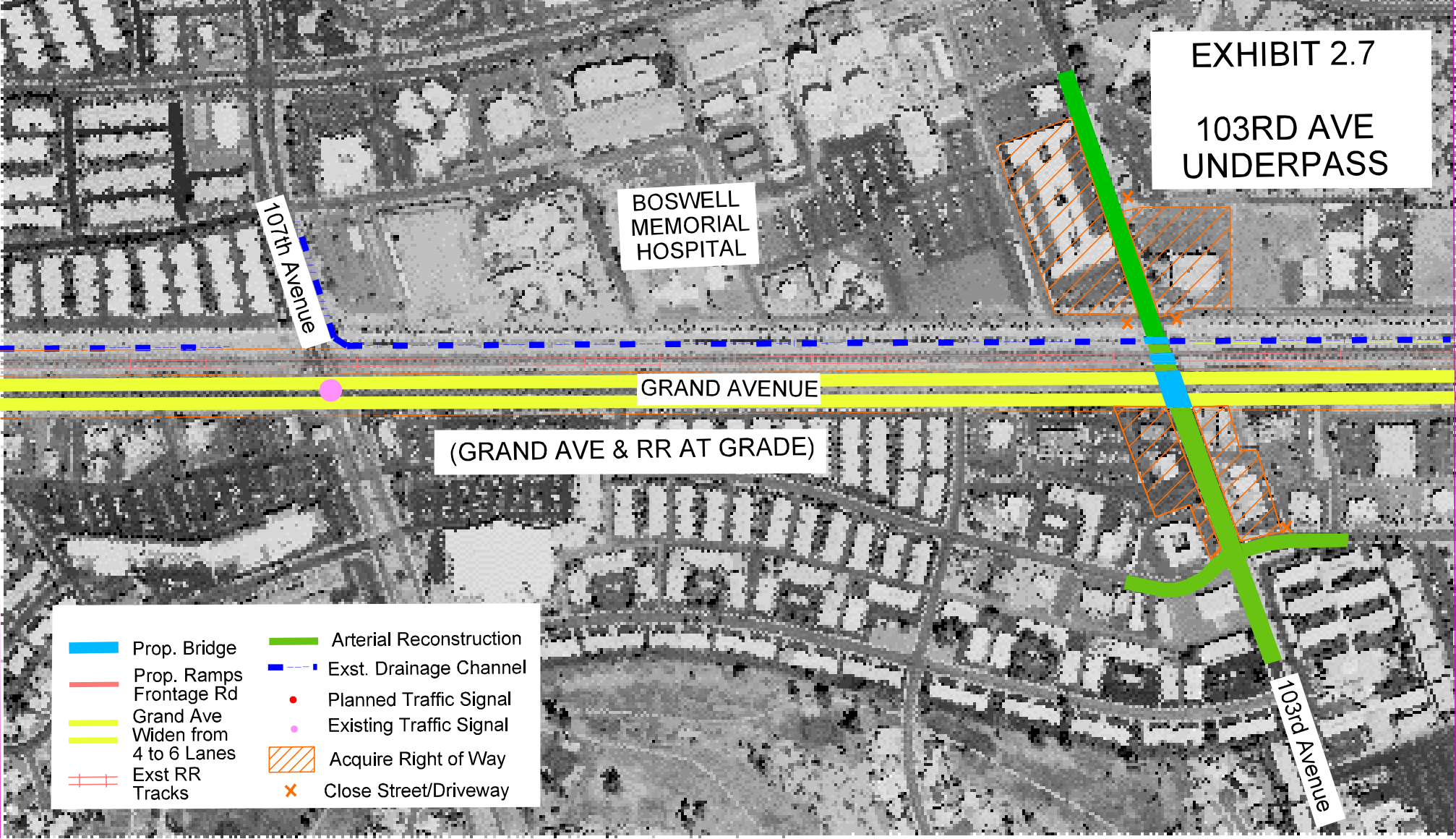
EXHIBIT 2.7
103RD AVE UNDERPASS
BOSWELL MEMORIAL HOSPITAL
107th Avenue
GRAND AVENUE
(GRAND AVE & RR AT GRADE)
103rd Avenue
Prop. Bridge
Prop. Ramps Frontage Rd
Grand Ave Widen from 4 to 6 Lanes
Exst RR Tracks
Arterial Reconstruction
Exst. Drainage Channel
Planned Traffic Signal
Existing Traffic Signal
Acquire Right of Way
Close Street/Driveway

The cost of right-of-way and construction of a grade separation would be approximately $24 million and would severely impact businesses and residences. Other than providing a grade separation with the railroad, the interchange is not needed to accommodate traffic design volumes. Maintaining good access to the hospital during construction may be difficult. The benefit of this grade separation is primarily to link the north and south portions of Sun City and to provide a grade separated link to Boswell Hospital from south of Grand. As a result, this project would require local funding.

Option E: **Emergency-Only Access:** An underpass could be provided under Grand Avenue and the BNSF Railroad located between 103rd Avenue and 107th Avenue. The underpass would provide one-way inbound access to the hospital. A northwest bound off-ramp and a southeast-bound off-ramp from Grand Avenue would be provided. Refer to Exhibit 2.8. Use of the underpass would be for emergencies only.

This alternative would require the hospital to participate as a partner in the project and allow construction on their property. It would also impact a residential area along the southwest side of Grand Avenue. The grade separation would cost approximately $7.5 million for right-of-way and construction.

Responses to the questionnaires were in favor of a grade separation to improve access to Boswell Memorial Hospital. Sunhealth Systems, owners of both hospitals, indicated that improved emergency access to Del E. Webb Hospital was more critical than Boswell Hospital because of the number of access routes currently available to Boswell. All of the alternatives will be expensive, require the relocation of residential and commercial property, and will disrupt traffic during construction. If the Hospital becomes a partner to the emergency only access, that option might be feasible. However, the availability of ADOT highway funds for such as access point is questionable.

The **Del E. Webb Memorial Hospital** is located on the northeast side of Grand and the railroad and just north of Meeker Boulevard. An interchange at Meeker and an emergency-only access options were identified and evaluated.

Option F: **Meeker/Reems**: An underpass for Meeker/Reems below Grand Avenue and the BNSF Railroad, both of which would both stay at-grade, could be constructed. The existing cross road skew is minimal at this location so a single point urban interchange would be possible. Approximately 74 feet of new right-of-way would be needed. The interchange would likely require the elimination/relocation of shopping centers on both sides of Reems Road. Refer to Exhibits 2.9 and 2.10. A shoofly for the railroad would be needed to construct the underpass. The drainageway between the railroad and Sun City West would require special design consideration in order to maintain the drainage flow and avoid having the Meeker/Reems underpass so deep that its impact would hamper access into the hospital and its cost would be prohibitive.

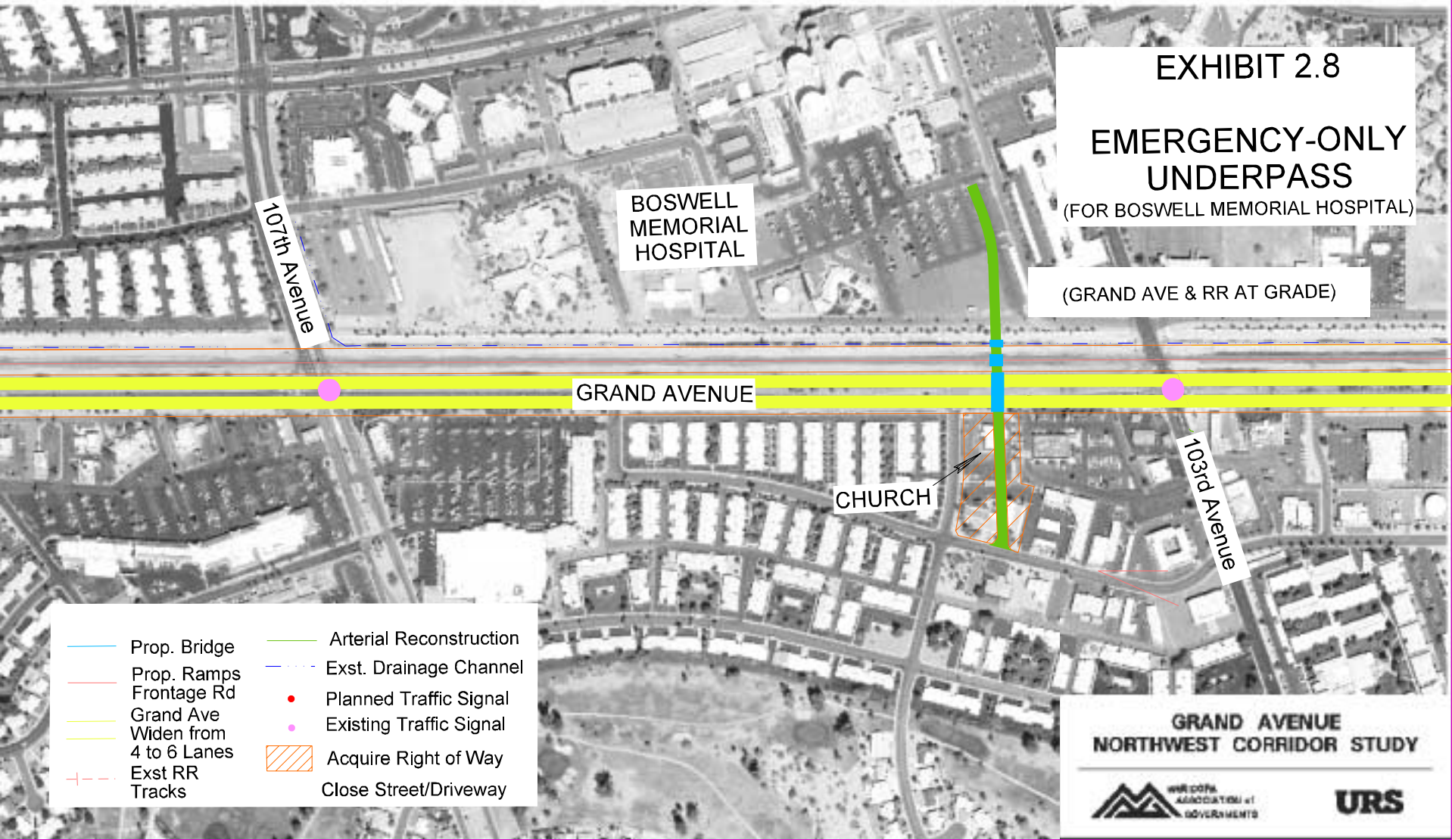
EXHIBIT 2.8
EMERGENCY-ONLY UNDERPASS
(FOR BOSWELL MEMORIAL HOSPITAL)
(GRAND AVE & RR AT GRADE)
BOSWELL MEMORIAL HOSPITAL
107th Avenue
GRAND AVENUE
CHURCH
103rd Avenue
Prop. Bridge
Prop. Ramps Frontage Rd
Grand Ave Widen from 4 to 6 Lanes
Exst RR Tracks
Arterial Reconstruction
Exst. Drainage Channel
Planned Traffic Signal
Existing Traffic Signal
Acquire Right of Way
Close Street/Driveway
GRAND AVENUE NORTHWEST CORRIDOR STUDY
URS

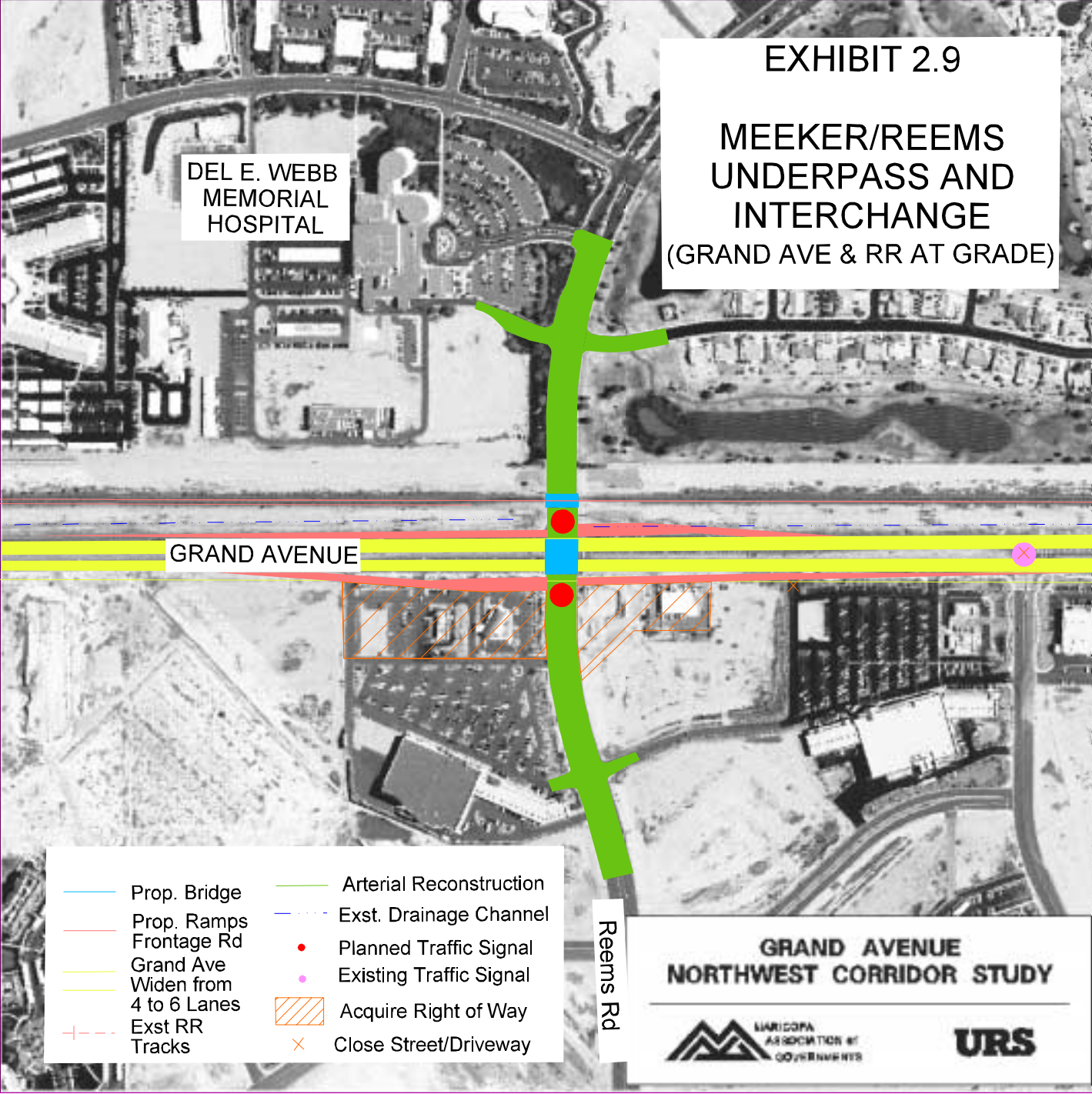
EXHIBIT 2.9
MEEKER/REEMS UNDERPASS AND INTERCHANGE
(GRAND AVE & RR AT GRADE)
DEL E. WEBB MEMORIAL HOSPITAL
GRAND AVENUE
Reems Rd
Prop. Bridge
Prop. Ramps Frontage Rd
Grand Ave Widen from 4 to 6 Lanes
Exst RR Tracks
Arterial Reconstruction
Exst. Drainage Channel
Planned Traffic Signal
Existing Traffic Signal
Acquire Right of Way
Close Street/Driveway
GRAND AVENUE NORTHWEST CORRIDOR STUDY
MARICOPA ASSOCIATION of GOVERNMENTS
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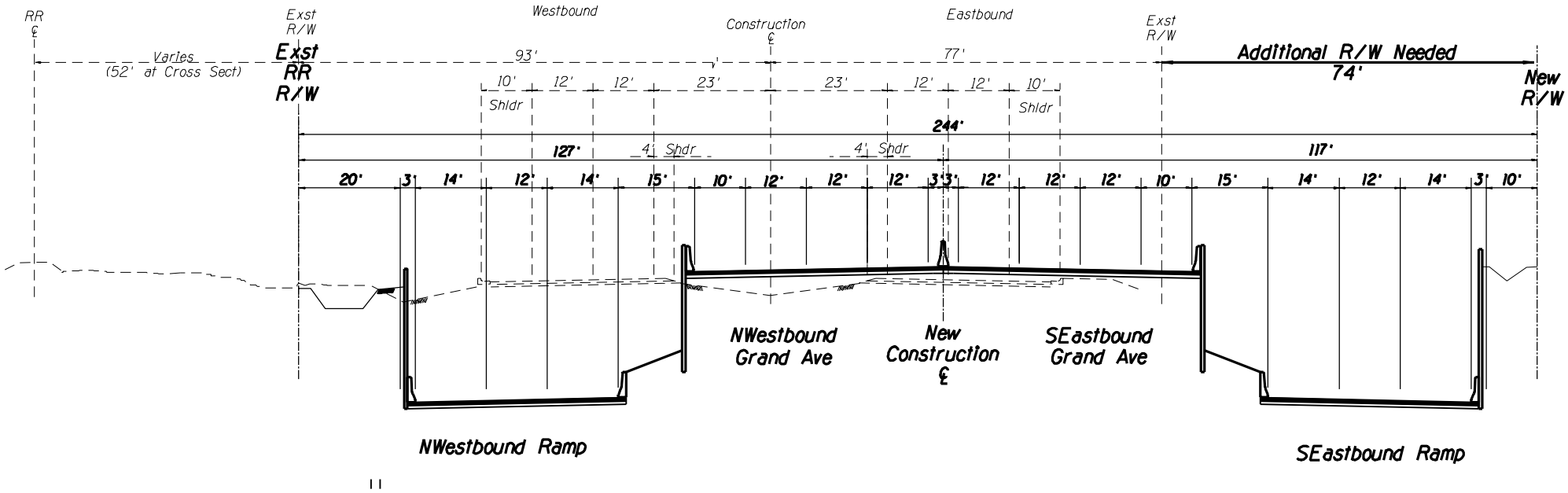
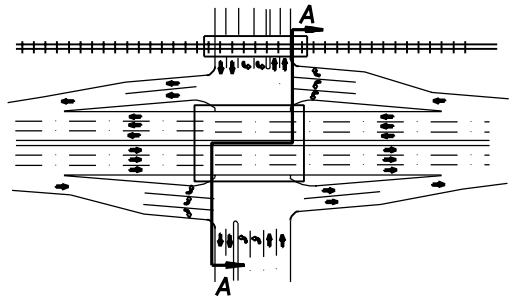




PROPOSED TIGHT SPUI/DIAMOND
PLAN VIEW

EXHIBIT 2.10
MEEKER/ REEMS UNDERPASS at GRAND AVENUE
CROSS SECTION A-A
(looking SE)

GRAND AVENUE
NORTHWEST CORRIDOR STUDY

MARICOPA ASSOCIATION of GOVERNMENTS

URS

The cost of right-of-way and construction of an interchange would be approximately $30 million. It would have major impacts to commercial areas. Other than providing a grade separation with the railroad, the interchange is not needed to accommodate traffic design volumes. Maintaining good access to the hospital during construction would be difficult; however, if the alignment of the new underpass is shifted to the south of the Meeker centerline, it may be possible to maintain some traffic flow on Meeker during construction. An interchange at this location would have large impacts on existing land uses. It would benefit travel on Grand Avenue by the removal of one or more traffic signals; it would enhance motorized and non-motorized travel across Grand, and it would enhance emergency access to the hospital.

Option G: **Emergency-Only Access:** An alternative to the interchange at Reems/Meeker would be an underpass under Grand Avenue and the BNSF Railroad located northwest of Reems Road. The underpass would provide one-way inbound access to the hospital. An northwest-bound and southeast-bound ramp from Grand Avenue would be provided. Refer to Exhibit 2.11. Use of the underpass would only be for emergencies. The grade separation would cost approximately $6 million.

Responses to the questionnaires were in favor of a grade separation to improve access to Del E. Webb Memorial Hospital. All of the alternatives will be expensive, require the removal of commercial property, and will disrupt traffic during construction. If the Hospital becomes a partner to the emergency only access, that option might be feasible. However, the availability of ADOT highway funds for such an access point is questionable.

In December 2001, the project team and MAG met with representatives of Sunhealth Systems, owners of both Del E. Webb and Boswell Hospitals. The access road as shown in Exhibit 2.11 is in conflict with hospital expansion which is now under construction. Sunhealth indicated a willingness to participate in a study to find a suitable location for a grade separation for use by public and private vehicles with passengers in need of emergency care. The study should include representatives from the Surprise Fire Department because they provide emergency service in the area. An emergency-only grade separation and the Meeker/Reems interchange should be included in the study.

2.3.2 Grade Separations for Capacity and to Promote Expressway Concept

All the intersections along Grand Avenue were reviewed for the need to provide grade separations. Three of those were dealt with as access to the hospitals and others are considered in the section on continuous routes. The only intersection that requires a grade separation in order to maintain an LOS D in 2025 is Bell Road. Listed below are all existing major intersections. If the grade separation is dealt with more specifically in another category, it is noted by "see Option _____."

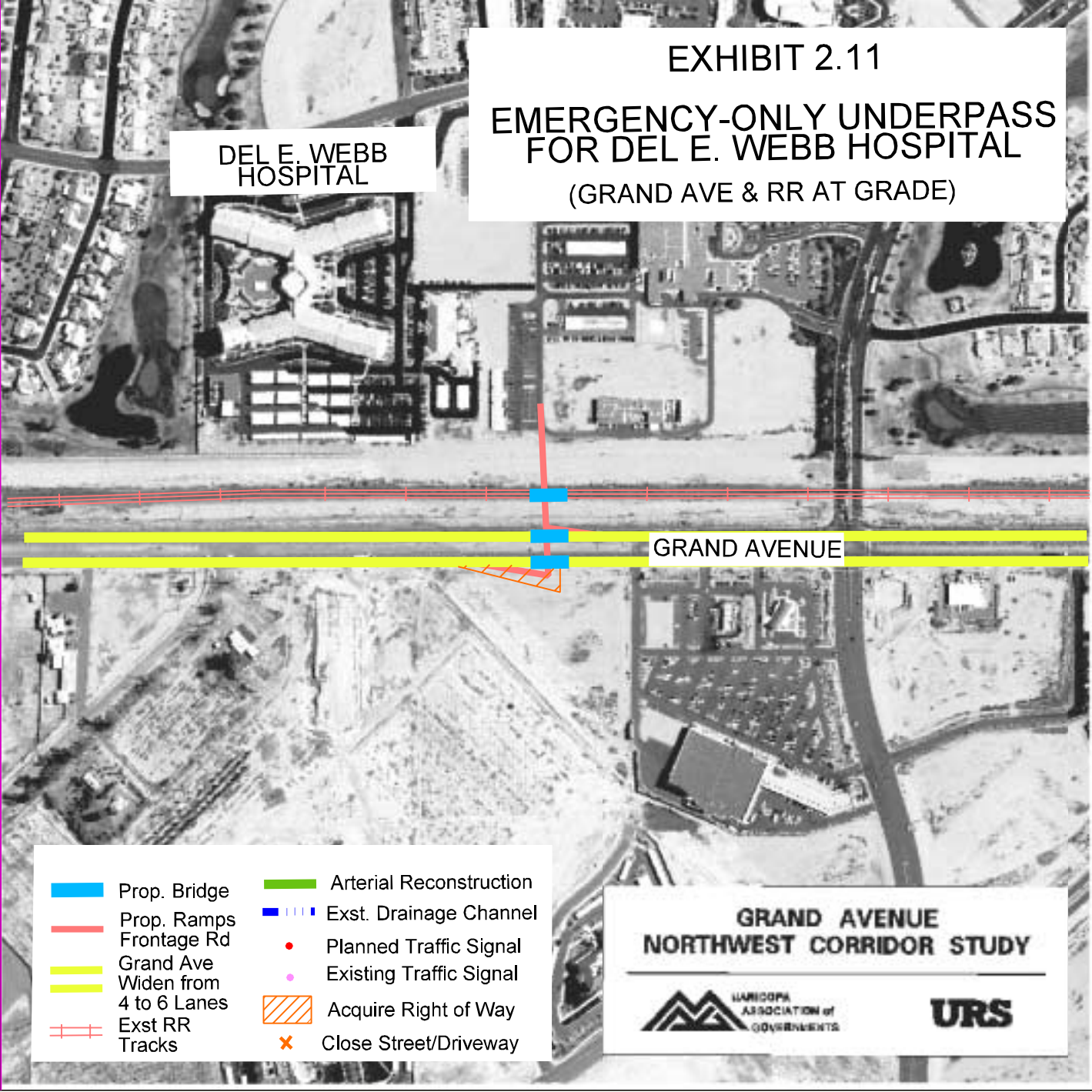


EXHIBIT 2.11
EMERGENCY-ONLY UNDERPASS FOR DEL E. WEBB HOSPITAL
(GRAND AVE & RR AT GRADE)
DEL E. WEBB HOSPITAL
GRAND AVENUE
Prop. Bridge
Prop. Ramps Frontage Rd
Grand Ave Widen from 4 to 6 Lanes
Exst RR Tracks
Arterial Reconstruction
Exst. Drainage Channel
Planned Traffic Signal
Existing Traffic Signal
Acquire Right of Way
Close Street/Driveway
GRAND AVENUE NORTHWEST CORRIDOR STUDY
MARICOPA ASSOCIATION of GOVERNMENTS
URS

The project team has reached a level of conclusion for each location. Several locations are labeled "Eliminate," which means that option does not appear to be feasible. Others are labeled "Low Probability" which means that the degree of impact is severe enough to make the probability of implementation very low. Two locations are labeled "Limited Value" which means that benefits are low compared to impacts. Only one location, RH Johnson/Sunrise, is labeled "Potential." In this area, it appears that Grand Avenue was aligned to provide additional right-of-way to accommodate a future interchange. However, the cross street is lower volume than most other streets so the value of the grade separation is limited. The value is even more limited if this is the only grade separation provided in the Grand Avenue study corridor. As a result, other than Bell Road, no additional locations were listed as "Options."

Grand Avenue/Major Street Intersection
Potential Grade Separations

Major Cross Street	Configuration	Comments	Feasibility
1. RH Johnson/Sunrise	Grand under	Right-of-way available; not high volume	Potential
2. Meeker/Reems	a) M/R under Grand/RR	See Option F	Low
	b) Grand Under	Land use impacts; remove one signal	Higher, but no grade separation with railroad
3. Bell Road	a) Bell under Grand	See Option H	Low because of drainage and cost
	b) Grand Under	See Option H	Low, but most needed
4. Dysart Road	Grand under	Land use impacts; drainage; less major street	Eliminate
5. Greenway Road	Greenway under	See Option K	Limited value
6. Railroad Spur	Grand under	See Option L	Limited value
7. 107th Avenue	a) Grand under	Severe land use impacts	Eliminate
	b) 107th under Grand/RR	See Option C	Eliminate
8. 99th Avenue	Grand under	Land use impacts	Low

Option H: **Bell Road**: Bell Road would be an underpass below Grand Avenue and the BNSF Railroad which would both stay at-grade. A diamond interchange would need to be used at this location because of the highly skewed crossroad (45 degrees). Refer to Exhibits 2.12 and 2.13. Traffic signals at the ramp terminals would be located on Bell Road. Approximately 23 feet of new right-of-way would be needed. The interchange would likely require the relocation of part of the shopping center being built on the south side of Bell Road west of Grand Avenue. The traffic signal into the Home Depot shopping center would be removed because of its close proximity to the interchange ramps. Likewise, the planned signal immediately on Grand south of Bell Road would also need to be removed (or not constructed). A shoofly for the railroad would need to be constructed to build the underpass. The grade separation would cost approximately $40 million.

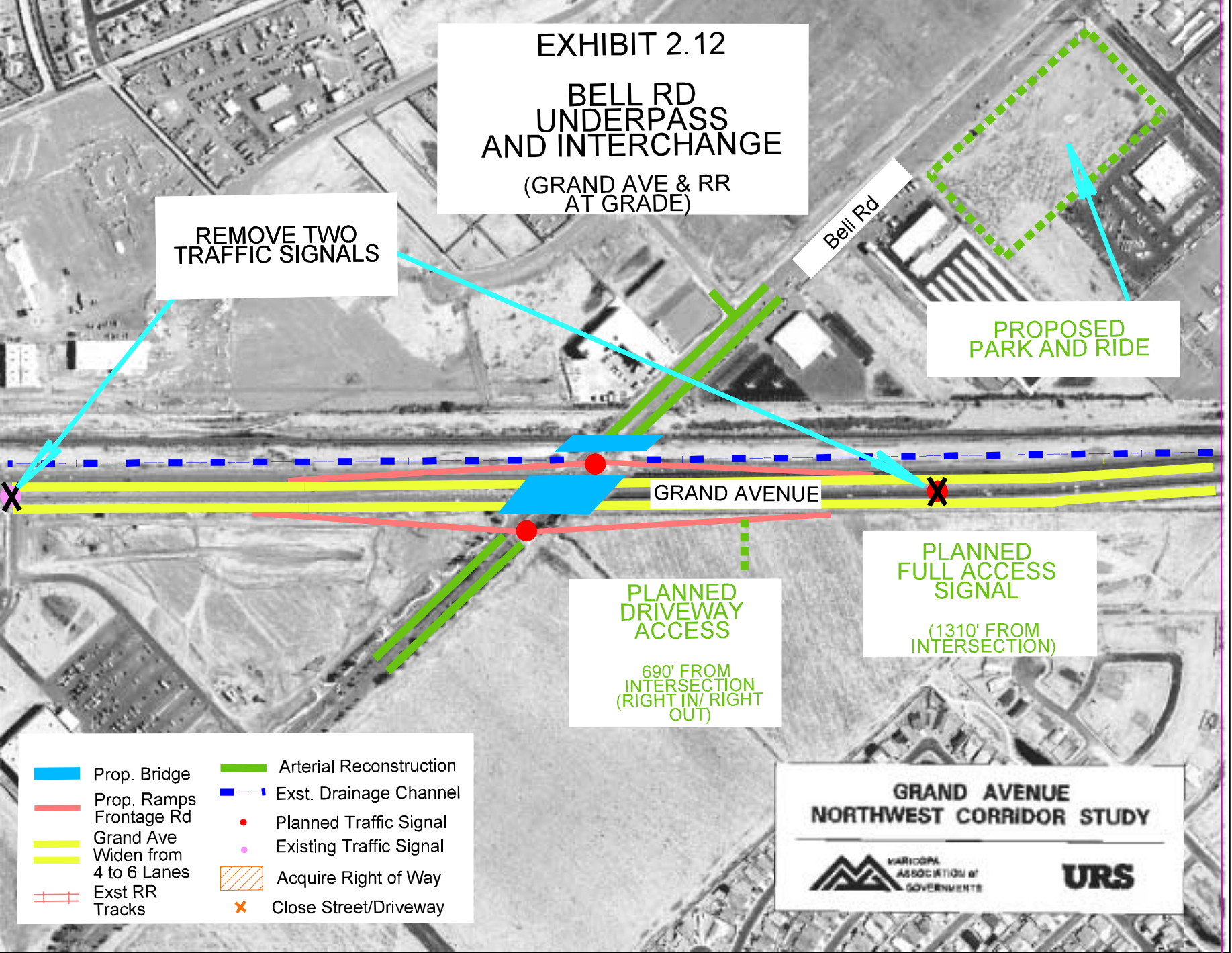
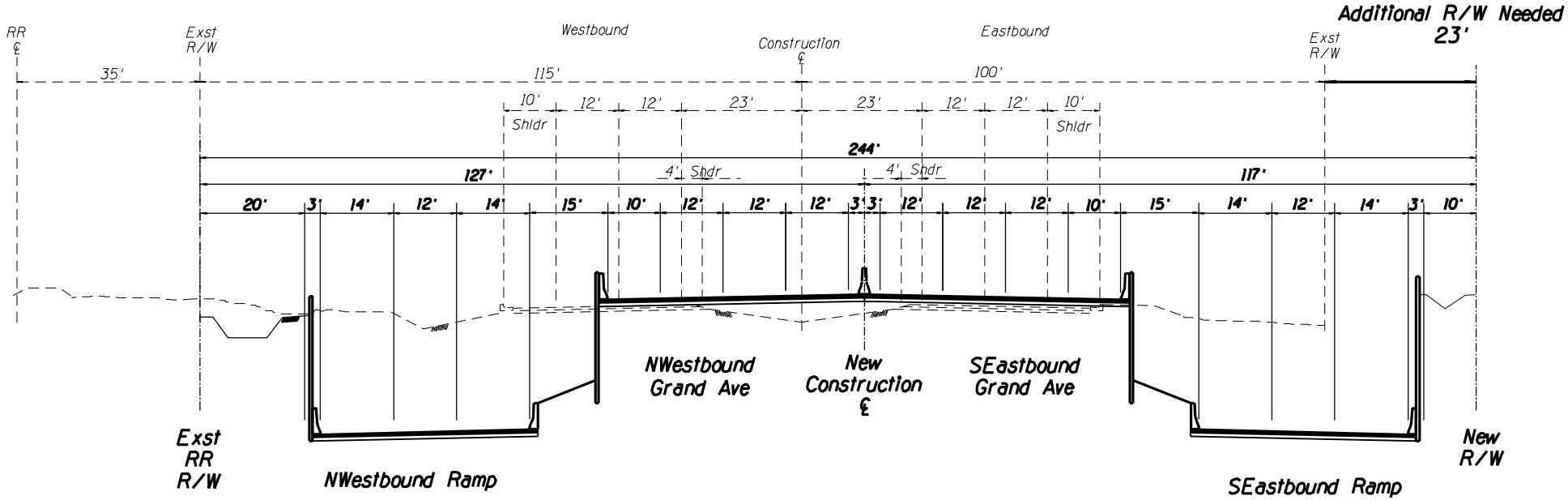
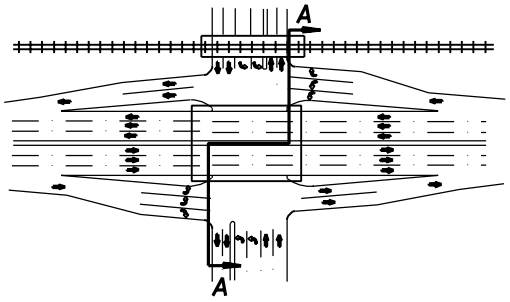


EXHIBIT 2.12
BELL RD UNDERPASS AND INTERCHANGE
(GRAND AVE & RR AT GRADE)
REMOVE TWO TRAFFIC SIGNALS
Bell Rd
PROPOSED PARK AND RIDE
GRAND AVENUE
PLANNED DRIVEWAY ACCESS
690' FROM INTERSECTION (RIGHT IN/ RIGHT OUT)
PLANNED FULL ACCESS SIGNAL
(1310' FROM INTERSECTION)
Prop. Bridge
Prop. Ramps Frontage Rd
Grand Ave Widen from 4 to 6 Lanes
Exst RR Tracks
Arterial Reconstruction
Exst. Drainage Channel
Planned Traffic Signal
Existing Traffic Signal
Acquire Right of Way
Close Street/Driveway
GRAND AVENUE NORTHWEST CORRIDOR STUDY
MARICOPA ASSOCIATION of GOVERNMENTS
URS





PROPOSED TIGHT DIAMOND
PLAN VIEW

EXHIBIT 2.13
BELL ROAD UNDERPASS at GRAND AVENUE
CROSS SECTION A-A
(looking SE)

GRAND AVENUE
NORTHWEST CORRIDOR STUDY

MARICOPA ASSOCIATION of GOVERNMENTS

URS

An alternative grade separation would be to depress Grand Avenue under Bell Road. Ramps would connect Grand Avenue with Bell Road and traffic signals at the ramp terminals would be located on Bell Road. The impacts and costs would be similar to the Bell Underpass.

Bell Road could also have an overpass over the railroad and Grand Avenue. Because of the vertical clearance requirements over the railroad, the overpass impacts would extend much further east and west along Bell Road as compared to the underpass. As a result, the overpass was not viewed as acceptable to the community.

Based on the design volumes, Bell Road will need to be grade separated with Grand Avenue to provide an acceptable level of service. Bell Road is a major east-west route through the West Valley and a grade separation would enhance Bell Road as a regional route. An interchange at this location has merit; however, the cost and impacts to existing commercial property would be extensive. Responses from the questionnaires showed strong support for this grade separation.

2.3.3 Continuous Routes Across the Corridor

Need: ***One of the deficiencies noted by the project team is the lack of continuous north-south and east-west arterials in the study area. Between Loop 101 and Loop 303, the only continuous north-south street is 99th Avenue. This configuration leaves an 8-mile gap in the arterial system. Bell Road on the north is the only east-west street between Olive Avenue on the south and Loop 303 (under construction). This is a distance of 9 miles. As a result, Grand Avenue must serve as US 60 and serve as the arterial system in a 70 square-mile area. If other routes could be extended, they would help relieve Grand Avenue and provide an opportunity to provide grade separations with Grand Avenue and the railroad. Three options were identified and evaluated.***

Option 1: **El Mirage/Thompson Ranch Road:** El Mirage Road is being upgraded to a six-lane arterial north of Bell Road. It will interchange with Loop 303 3 miles north of Bell. South of Bell Road, El Mirage Road is a five-lane arterial. It has recently been connected to Thompson Ranch Road which curves to the east, serves the BNSF automobile yard, and connects to Grand Avenue at a signalized intersection. Thunderbird Road is the south leg of this intersection. It curves sharply to the west just south of the intersection. The route provides some local circulation but does not serve a more community-wide or regional function.

An alternative would be to extend El Mirage/Thompson Ranch Road on a bridge over Grand Avenue and the BNSF Railroad, which would both stay at-grade. Refer to Exhibit 2.14. This new overpass roadway would be extended southward to Olive Avenue or Northern Avenue and would tie to El Mirage Road to the north. A half diamond interchange on the south and a two-way connector road with signals to the north would provide access to Grand Avenue. The proposed crossroad skew is approximately 7 degrees at this location. The existing signal at Thompson Ranch Road and Grand Avenue would remain. The grade separation would cost approximately $21 million. An additional $14 million would be needed to extend the road to Olive for a total project cost of $35 million.

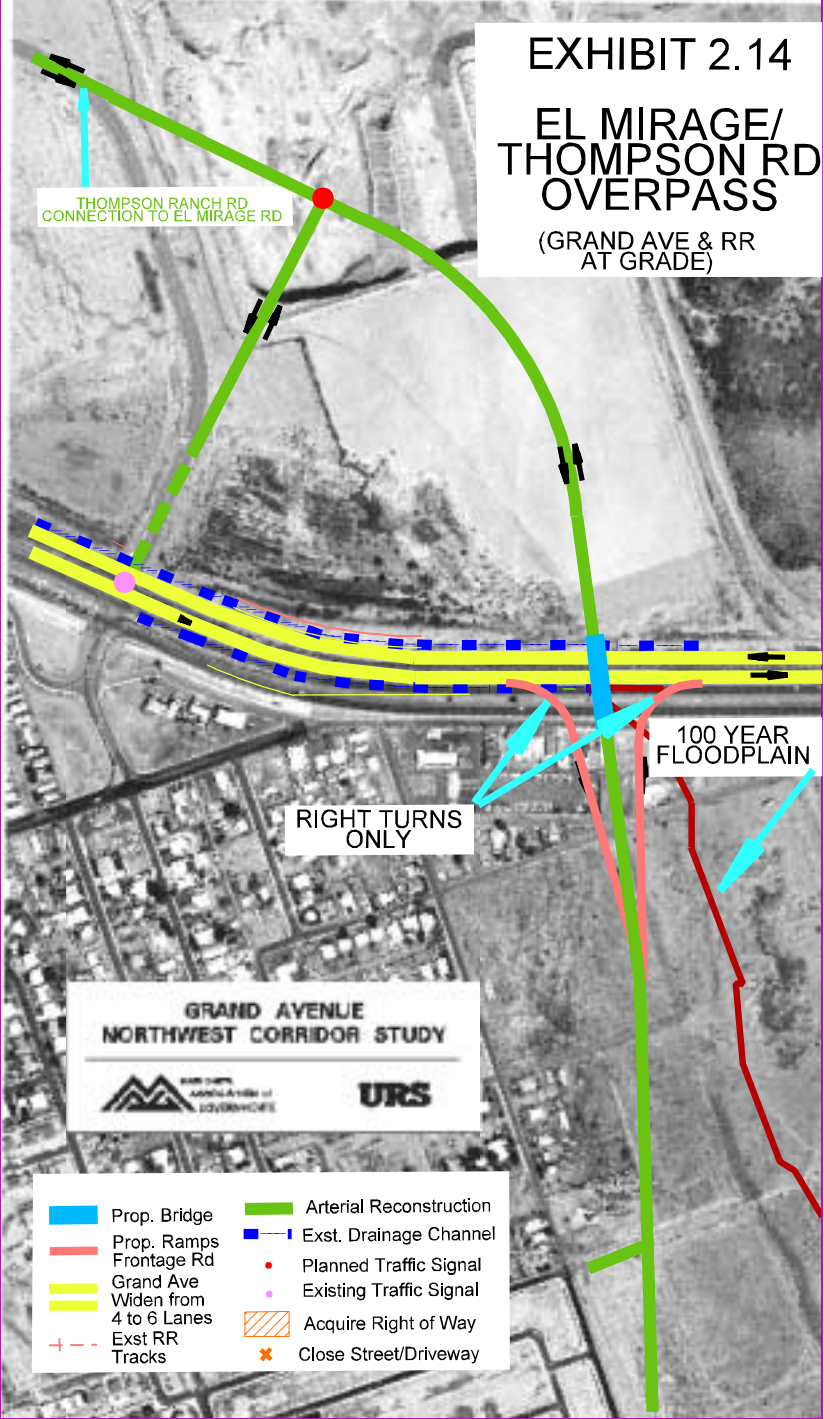


EXHIBIT 2.14
EL MIRAGE/ THOMPSON RD OVERPASS
(GRAND AVE & RR AT GRADE)
THOMPSON RANCH RD CONNECTION TO EL MIRAGE RD
RIGHT TURNS ONLY
100 YEAR FLOODPLAIN
GRAND AVENUE NORTHWEST CORRIDOR STUDY
URS
Prop. Bridge
Prop. Ramps Frontage Rd
Grand Ave Widen from 4 to 6 Lanes
Exst RR Tracks
Arterial Reconstruction
Exst. Drainage Channel
Planned Traffic Signal
Existing Traffic Signal
Acquire Right of Way
Close Street/Driveway

The grade separation has merit in providing an addition north-south through route within the study area. However, new development is occurring south of Grand Avenue in El Mirage. This proposed route would impact the new residential areas. Responses from the questionnaires showed general support for this grade separation. Without the full support of the City of El Mirage, this option is not feasible.

Option J: **El Mirage Road:** A second option for El Mirage Road would be to extend it southwestward from the point where it meets Thompson Ranch Road and Greenway Road. It would be extended over the BNSF Railroad and Grand Avenue. Refer to Exhibit 2.15. The road would be realigned to the west around existing residential development between Thunderbird Road and the BNSF Railroad spur. The road would then turn eastward, cross the BNSF spur track at-grade and reconnect with El Mirage Road. There would be no connections with Grand Avenue. The grade separation would cost approximately $20 million. An additional $11 million would be needed to connect the roadway back to the existing El Mirage Road alignment south of Thunderbird Road for a total project cost of $31 million.

The overpass has merit in providing an additional north-south route for the corridor. Any new development along the proposed alignment could eliminate the possibility of realigning El Mirage Road. Accordingly, the full support of the City of El Mirage will be needed to preserve the option and to implement the grade separation.

Option K: **Greenway Road**: A variation of the above option would be to extend Greenway Road as an underpass below Grand Avenue and the BNSF Railroad, which would both stay at-grade. Ramps would be provided using a diamond interchange. Refer to Exhibits 2.16 and 2.17. A single point urban interchange cannot be utilized here because of the highly skewed crossroad (45 degrees). Greenway Road would be improved to El Mirage Road, north of Grand Avenue and to Litchfield Road south of Grand Avenue. The narrow existing right-of-way requires Grand Avenue to be realigned slightly to the south to make room for the northwest bound on/off-ramps abutting the railroad right-of-way. A shoofly for the railroad would need to be constructed to build the underpass.

Approximately 29 feet of new right-of-way is needed. The interchange would likely require the relocation of a building at the Floral Lakes Memorial Gardens Cemetery and the relocation of three or four businesses southwest of Grand Avenue and along Greenway Road. There are schools along Greenway Road west of Grand. The two-way frontage road would also be realigned. The underpass would disconnect residential neighborhood access to Greenway Road through the depressed sections (approximately 1,000 feet on either side of Grand Avenue). The grade separation would cost approximately $30 million to construct.

Responses from the questionnaires showed it was the least supported grade separation.

EXHIBIT 2.15

EL MIRAGE ROAD OVERPASS

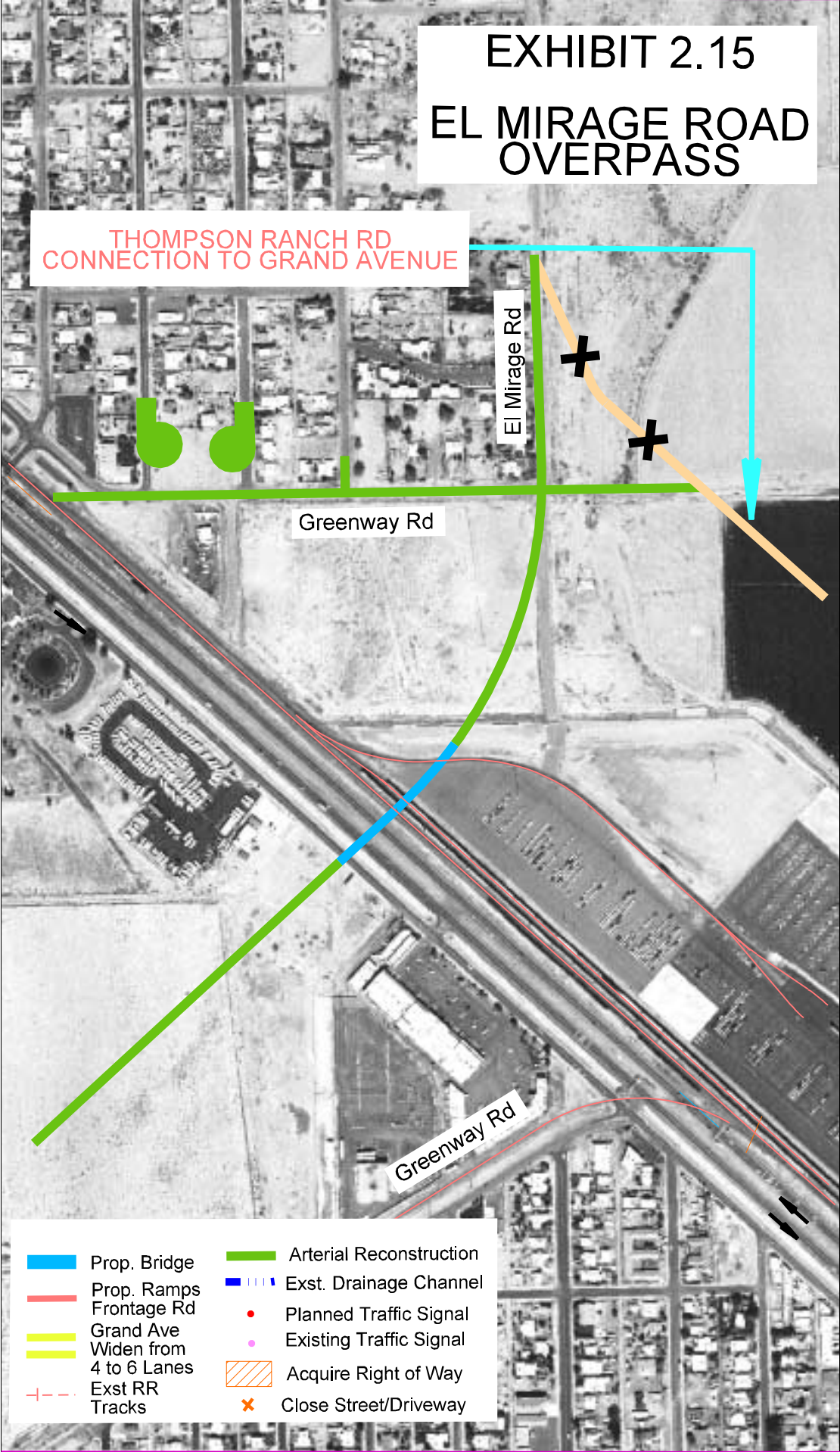
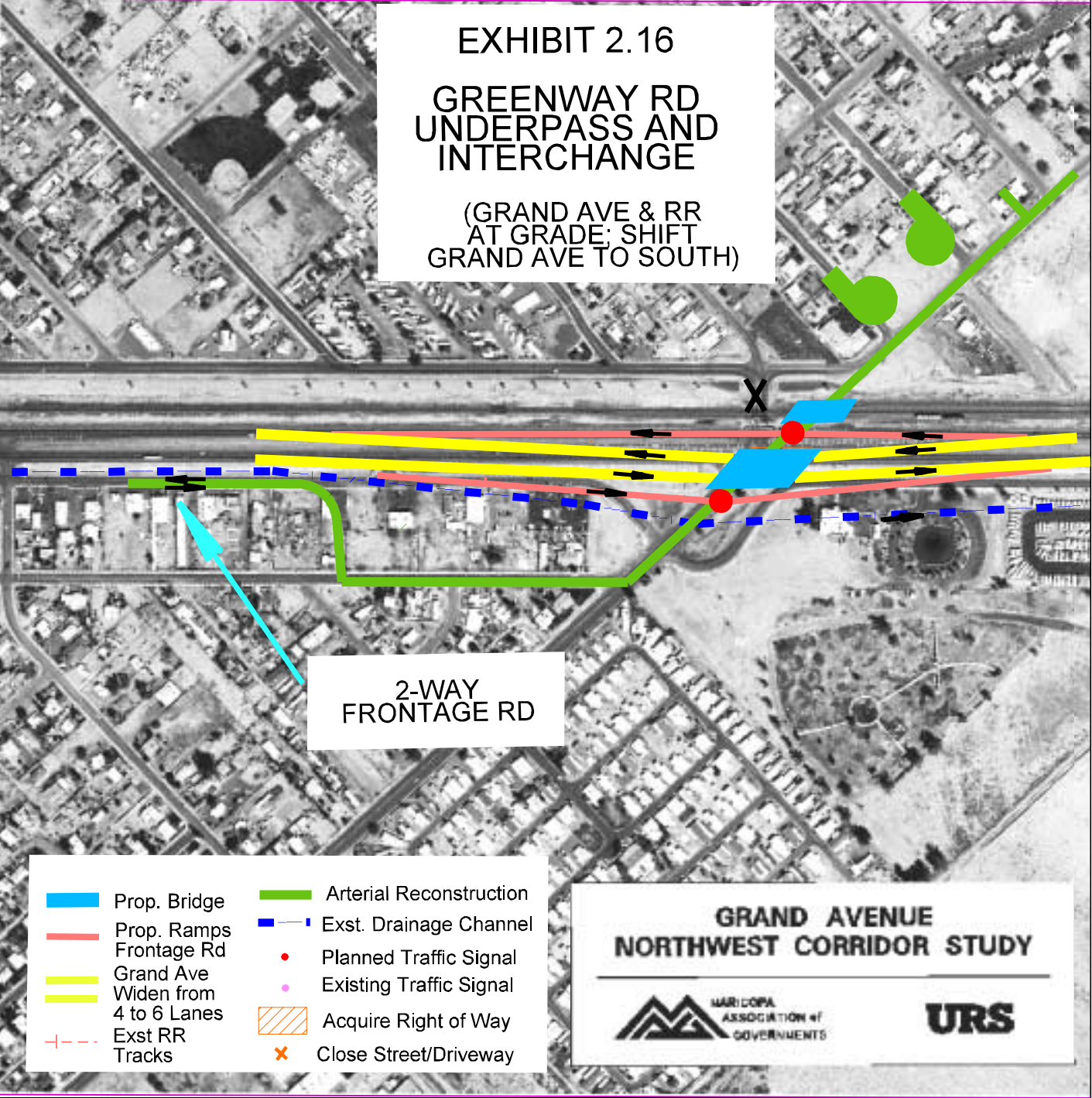


EXHIBIT 2.16

GREENWAY RD UNDERPASS AND INTERCHANGE

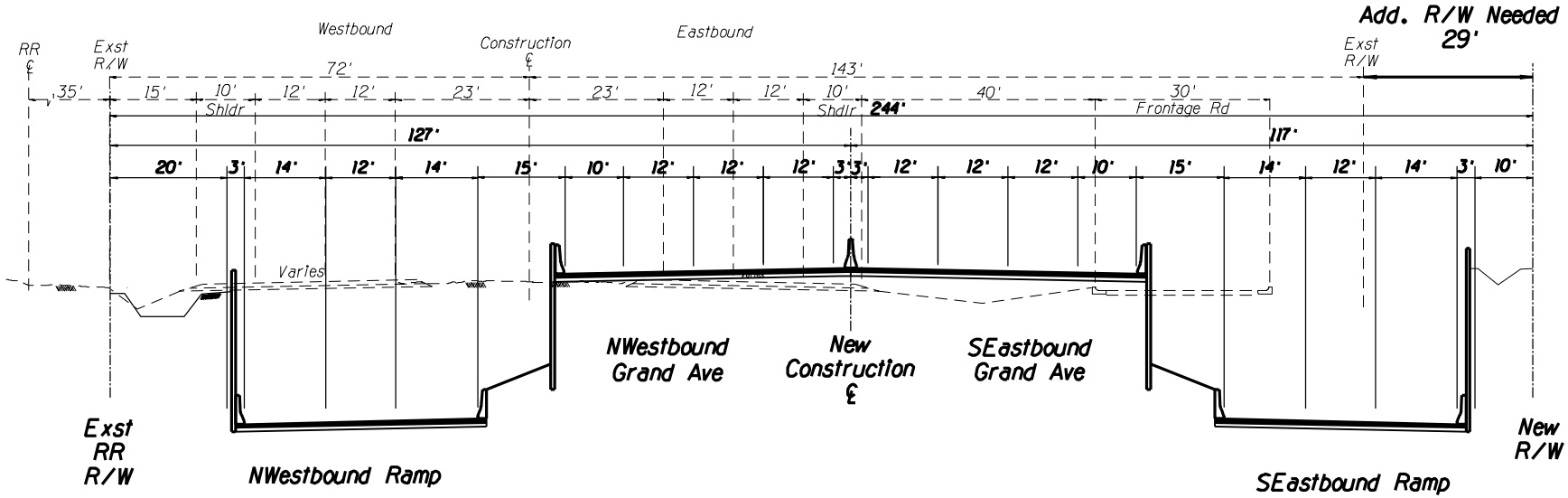
(GRAND AVE & RR AT GRADE; SHIFT GRAND AVE TO SOUTH)

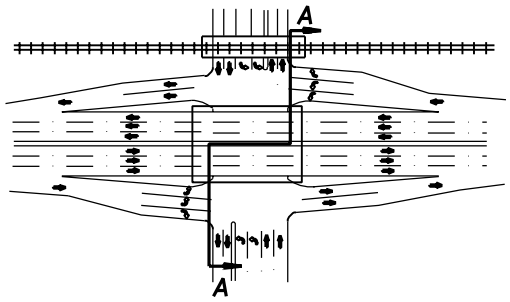


GRAND AVENUE
NORTHWEST CORRIDOR STUDY

MARICOPA ASSOCIATION of GOVERNMENTS

URS





PROPOSED TIGHT DIAMOND
PLAN VIEW

EXHIBIT 2.17
GREENWAY UNDERPASS at GRAND AVENUE
CROSS SECTION A-A
(looking SE)

GRAND AVENUE
NORTHWEST CORRIDOR STUDY

MARICOPA ASSOCIATION of GOVERNMENTS

URS

2.3.4 Grand Avenue Underpass at BNSF Railroad Spur Track

Need: The only place that Grand Avenue crosses a railroad track within the study area is near the El Mirage section line where the Ennis Spur heads southwest from the BNSF mainline. This spur is used approximately once per day. Consideration was given to grade separating Grand and this spur in order to improve safety and to eliminate traffic delays due to trains.

Option L: Grand Avenue would become an underpass and pass below the BNSF Railroad Spur Track. Refer to Exhibit 2.18. The traffic signal at Primrose Street would be removed because the intersection falls within the depressed section of Grand Avenue. The BNSF Railroad Spur Track could be raised a few feet to minimize the depth and length of the underpass. The underpass would cost approximately $17 million.

If the majority of the traffic signals remain, Grand Avenue would not be upgraded to a more free-flow facility. As a result, this grade separation is not essential. Trains infrequently disrupt traffic on Grand Avenue. Even if more BNSF Railroad customers locate along the spur line, delays due to the train would create an insignificant amount of delay compared to the delay created by the remaining traffic signals. The existing at-grade crossing is protected by gates and flashers. Removing the signal at Primrose Street would make travel in and out of the City of El Mirage more difficult. Responses from the questionnaires showed general support for this grade separation. Because of the high cost and limited benefits, a grade separation with the railroad spur is not cost-effective.

2.4 Access Management on Grand Avenue

Four elements were considered in access management: eliminate traffic signals, eliminate median breaks for left turns, minimize additional property access and pavement markings. Each of these elements has the potential of improving traffic safety, reducing traffic delays on Grand Avenue, and minimizing side friction with traffic from driveways and local streets.

Grand Avenue has a higher degree of access control than almost all arterials in the metropolitan area due to the railroad located on the northeast side of the roadway. Street crossings of the railroad are limited. In addition, the Sun City developments have generally limited property access to Grand and limited local street connections to Grand. As the new development occurs in the City of Surprise from Dysart Road to the northwest, numerous commercial properties have been built with driveway access to Grand and new traffic signals have been installed.

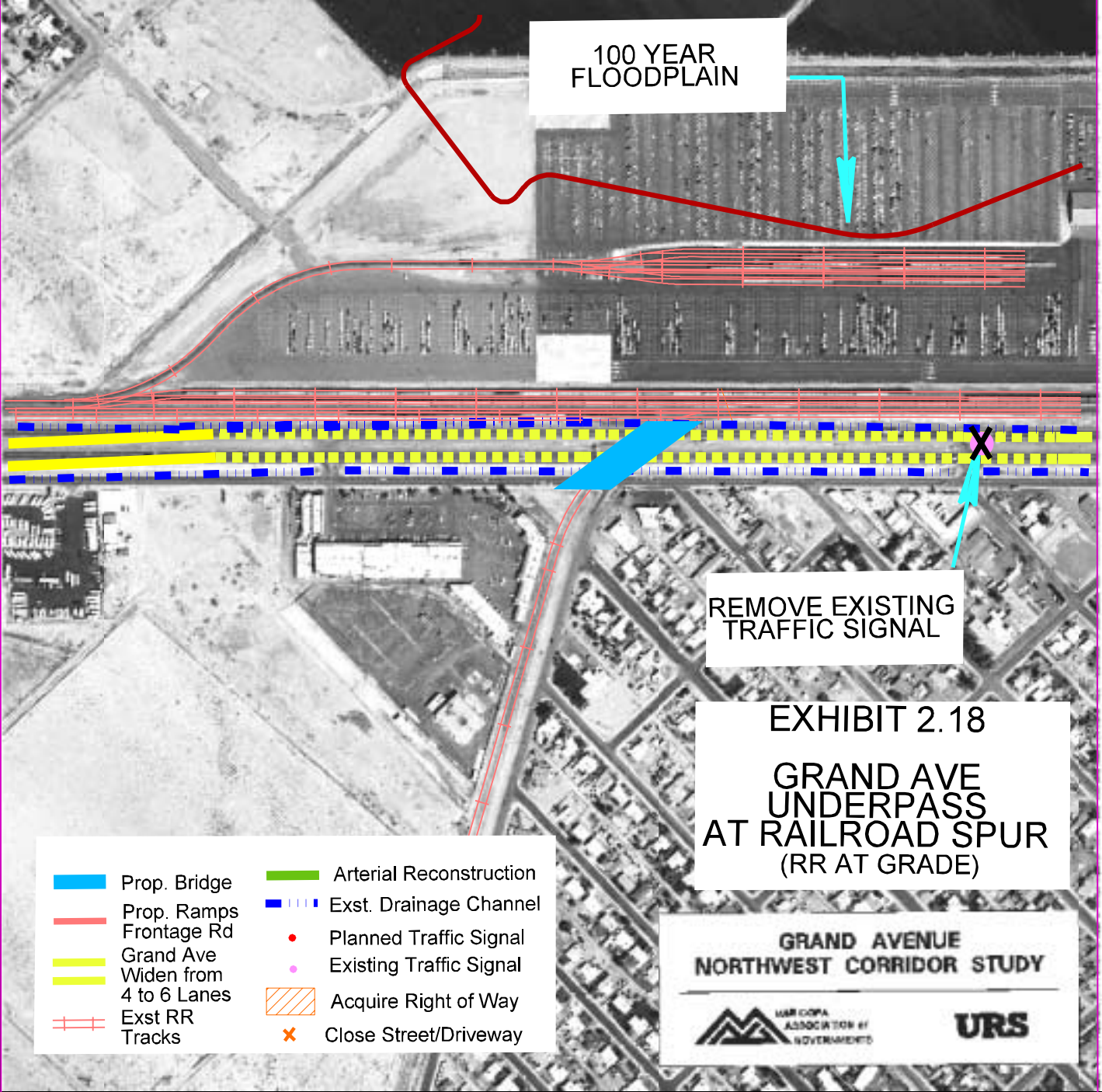


EXHIBIT 2.18

GRAND AVE UNDERPASS AT RAILROAD SPUR

(RR AT GRADE)

GRAND AVENUE
NORTHWEST CORRIDOR STUDY

MARICOPA ASSOCIATION of GOVERNMENTS

URS

2.4.1 Remove Traffic Signals

Traffic signals on Grand Avenue would be removed if grade separations described above in several options are implemented. As a result, this action is not considered to be an independent option. The potential signal removals are as follows:

- Option D; 103rd Avenue for access to Boswell Hospital
- Option C: 107th Avenue for access to Boswell Hospital
- Option K: Greenway Road for interchange
- Option H: Planned signal for shopping center south of Bell, Bell Road signal, and Town Center Drive for Bell Road interchange and perhaps Litchfield Road
- Option F: Parkview Place and Meeker/Reems for access to Del E. Webb Hospital
- Option L: Primrose Lane for railroad spur underpass

Consideration was given to removal of the 113th Avenue signal because of its close proximity to the 111th Avenue signal. This close signal spacing substantially hampers the ability to provide good signal progression. Much of Youngtown's commercial businesses are located at this signal so that its removal could have major economic impacts for Youngtown.

Need: ***Reduce the number of traffic signals on Grand with 19 signals in 11 miles. The signal density along Grand is too great to meet the enhanced arterial/limited expressway expected levels of traffic services. The diagonal nature of Grand helps create very uneven signal spacing which greatly complicates good signal progression***.

Option M: To achieve good travel speeds through this section of Grand Avenue, the removal of the following signals should be considered whether or not grade separations are constructed:

1. Parkview Place
2. Proposed signal at Mountain View extended
3. Litchfield Road
4. Town Center Drive
5. Planned signal south of Bell
6. Primrose Lane
7. 113th Avenue

2.4.2 Eliminate Median Breaks for Left Turns

Need: ***Left turns across fast moving traffic on Grand Avenue is an inherent safety hazard. However, left-turn access is needed to provide local traffic circulation and access to businesses and other properties along Grand Avenue***.

Option N: Left turn median breaks would be eliminated at the following locations:

Beardsley Road

Sunny Lane

Shopping Center, south of Greenway Road

108th Avenue

106th Avenue

105th Avenue

101st Avenue

Median break, east of 99th Avenue

Responses from the questionnaires were mixed for eliminating median breaks along Grand. The elimination of median breaks would have little impact on traffic congestion within the corridor. However, it will promote traffic safety. This issue should be examined further when specific plans are developed for widening Grand Avenue.

2.4.3 Policy to Limit New Access to Grand Avenue

Need: Responses from the questionnaires were mixed for limiting new access to Grand Avenue and removal of existing access. If new access to Grand Avenue is not restricted, demand for new traffic signals will increase. With each new signal, travel on Grand Avenue will become more congested and travel speeds will be reduced.

Option O. New access should be restricted to preserve Grand Avenue as a major regional route. Access limitations would be developed in cooperation with the local jurisdictions and enforced through the access permitting process.

2.4.4 Pavement Markings and Lane Designations

Local agencies and the public identified safety and traffic operational concerns. It is beyond the scope of this project to conduct a detailed study of pavement markings, lane designations and signage. It does appear that such a study is warranted and should be conducted as a follow-up to this corridor study.

3.0 OPERATIONAL AND AESTHETIC IMPROVEMENTS

Need: The public and local agencies were in general support of improving the aesthetics of the corridor, particularly by providing more landscaping within the corridor. Throughout the majority of the corridor, there is additional right-of-way and wide medians where landscaping could be provided. Generally, ADOT will provide landscaping with its projects to a modest degree. Local jurisdictions are usually responsible for the maintenance.

Option A: Landscaping would be provided the length of the corridor, both on the outside of the roadway and within any median areas. Street lights would be provided at intersections and along areas with sidewalks.

Need: In addition to the infrastructure options discussed above, local agencies and the public identified several safety and traffic operational problems that need to be addressed within the corridor. The following studies would address these issues.

Option B: Traffic signage within the corridor would be evaluated. Special emphasis would be placed on signs that meet the needs of the elderly population. Suggested improvements for traffic signs include providing larger letters and clear and concise directions on signs. City and County signage should be included in the evaluation.

Option C: A traffic barrier (guardrail) would be provided between the drainage channel and Grand Avenue. The space between the roadway and the channel is very limited, and it may not be possible to install guardrail without reconstruction of the channel.

Need: There seems to be unanimous support from both local agencies and the public for providing signal coordination along Grand Avenue. The conduit and fiber installation would cost between $2-$2.5 million. Implementing ITS applications along Grand Avenue is consistent with regional ITS plans. The traveling public would receive a significant benefit in reduced congestion and delay if signals are coordinated along Grand Avenue.

Option D: The ITS "Smart Corridor" would be extended along Grand Avenue from Bell Road to Loop 303. A conduit would be provided along Grand Avenue from Loop 101 to Loop 303 for fiber-optic communications to support Smart Corridor traffic management functions. Additional ITS applications consistent with the MAG ITS Strategic Plan such as signal coordination would be implemented.

Need: The following signal changes were identified to accommodate 2010 and 2025 design volumes.

- Include a signal overlap phase for NB and SB right-turn lane at Thunderbird Road and Thompson Ranch Road
- Include NB/SB protected left-turn phase (implementation is currently under evaluation by ADOT) on Meeker Boulevard and Reems Road
- Include a signal overlap phase for EB right-turn lane on Bell Road
- Include NB/SB protected left-turn phase on RH Johnson Boulevard

Option E: To accommodate the above signal improvements throughout the corridor, the signal equipment would be evaluated at all intersections with exclusive left- and right-turn lanes. The controller, loops and signal heads would be capable of providing protected left-turn phases and right-turn overlap phases. Signal preemption equipment for emergency vehicles would also be

provided at all signalized intersections. Upgraded signal equipment would allow safer and more efficient traffic operations at the signals.

Need: In addition to the infrastructure improvement discussed above, local agencies and the public identified several safety problems that need to be addressed within the corridor. The following studies are recommended to address these issues.

Option F: Safety device operations such as gates would be evaluated for installation at all the railroad crossings.

Option G: Signal timing allowances for pedestrian crossings would be evaluated at all intersections.

4.0 TRANSIT AND OTHER MODES

Needs were identified in Working Paper No. 7. Presented below are action options which address those needs. These options are formulated for agency and public review and comment prior to development of recommendations to be included in the final report. Funding sources to implement the actions have not been identified. Those actions that become part of the final recommendations must be implemented through a combination of programs of the local jurisdictions, regional providers, and private developments.

4.1 Transit

The optional actions listed below are intended to meet transit needs in the Grand Avenue Northwest Corridor, as identified in Working Paper No. 7, Alternative Mode Needs.

Commuter rail operating on the BNSF railroad trackage is a possibility; however, with only one track heavily used by freight traffic limits the potential. Some preliminary discussions have been held regarding the potential to intercept some of the freight traffic at the edge of the city and put the goods onto trucks. The remaining rail freight traffic would be delivered at night thus making the trackage available for commuter rail during the day. This operation could increase the net usage of the track and the amount of nighttime maneuvers. There may be adverse impacts created. These issues will be addressed in the commuter rail study being undertaken by MAG.

Light rail transit (LRT) in the corridor is also a possibility. There may be a possibility of constructing the LRT on BNSF right-of-way. The presence of LRT and freight railroad would exacerbate the auto-rail and pedestrian-rail conflicts that current exist in the corridor. Glendale is currently studying extension of the LRT from Phoenix to Glendale. Once this location is determined, further extension to the north and/or west would be the logical subject of future study efforts.

Since transit improvements should be made as part of large system improvements which are beyond the scope of this corridor study, no specific cost estimates have been made for the various options. In reviewing these options, it may be helpful to consider typical unit costs obtained from RPTA:

Operating Cost per	Revenue-mile	
	Fixed Route	$4.14
	Dial-A-Ride	$2.56
	All Services	$3.39
Operating Cost per	Revenue-Hour	
	Fixed Route	$58.90
	Dial-A-Ride	$37.18
	All Services	$52.00
Capital Cost		
	Standard Bus	$310,000
	Bus Less than 30 Feet	$60,000 (Sun City Transit Area)
	Dial-A-Ride Van	$45,000

Federal government often pays 80% of capital costs.

A. Need: The regional bus system needs to be extended through the study corridor into Surprise, El Mirage, Sun City and Sun City West.

Option A1: Local bus service on Grand Avenue would be extended from downtown Peoria to Surprise and Sun City West, terminating in the vicinity of Del E. Webb Memorial Hospital. This route would bring regional service to Sun City, El Mirage, Surprise and Sun City West. An extension of the existing Yellow Line would provide through service to the State Capitol, downtown Phoenix and downtown Tempe. This option is appropriate to be implemented in the short term, as soon as a funding source can be secured. *Responsibility: El Mirage, Surprise, Youngtown, Maricopa County, RPTA.*

Option A2: Other existing regional routes would be extended, and new routes would be developed through the study corridor. Routes that have been recommended in previous studies include: extension of the Bell Road route (170) west to Surprise, extension of the Thunderbird route (138) west to Boswell Memorial Hospital, and a new north-south route on Dysart Road. This option is appropriate to be implemented in the short term, as soon as a funding source can be secured and as demand warrants. *Responsibility: El Mirage, Surprise, Maricopa County, RPTA.*

Option A3: Appropriate locations for on-street bus bays (also known as pullouts) would be identified and constructed as funding permits. A sufficient number bays would be provided so that vehicles could pass stopped buses, but transit vehicles would not be unduly delayed by waiting for gaps to re-entry the traffic stream. The best locations for bus bays are generally at the far side of signalized intersections, where the signal creates periodic gaps. Timepoints, where buses running early must wait until their scheduled time, are often desirable locations for bus bays. Bus bays would not be located where entering or exiting ramp traffic may interfere with buses pulling out or re-entering traffic lanes. *Responsibility: El Mirage, Surprise, Youngtown, Maricopa County.*

B. Need: Bus stops in the study corridor need to be designed to maximize passenger safety and comfort.

Option B1: As bus service is extended into the corridor on Grand Avenue and other roads, bus stops would be placed approximately one-fourth mile apart, and at all major intersections containing commercial nodes. As many stops as possible would be equipped with shaded benches, landscaping, trash cans, resting bars and posted timetables. Stops would be set well back from the traveled roadway surface, and buffers provided to the extent feasible. All bus stops would be accessible to mobility-challenged riders and located close to crosswalks and entrances to walled-off neighborhoods. At major transfer points such as Grand Avenue/Bell Road, the use of both near-side and far-side stops to facilitate transfers in all directions would be considered. If grade-separated interchanges are to be constructed, they would be designed so as to avoid excessive walk distances for bus riders, especially those who need to transfer. In general, the guidelines in the Valley Metro Bus Stop Handbook would be followed. *Responsibility: El Mirage, Surprise, Youngtown, Maricopa County.*

C. Need: Paratransit (including Dial-a-Ride) services throughout Northwest Corridor communities require restructuring to better meet travel needs, especially those of older residents.

Option C1: The short-term feasibility of better coordinating services offered by the Peoria, El Mirage, Surprise and Sun Cities Dial-a-Ride systems would be studied, with a view to implementing a combined system, similar to the existing East Valley Dial-a-Ride. Participants would include MAG, RPTA, MCDOT, the operators of the non-profit Sun Cities Area Transit, and the cities of El Mirage, Peoria and Surprise. The most important elements for the short term would be a common fare structure and the ability to cross jurisdictional boundaries, at least to a limited extent, without changing vehicles. If bus service is extended into the corridor, efficient transfers between regional bus routes and dial-a-ride should be available. The ultimate goal should be a completely seamless West Valley Dial-a-Ride system. *Responsibility: Peoria, El Mirage, Surprise, Youngtown, Maricopa County, Sun Cities Area Transit, RPTA, MAG.*

Option C2: In the short- to mid-term, the feasibility and cost-effectiveness of innovative approaches to serving seniors and persons with disabilities would be studied. Such approaches could supplement or even replace Dial-a-Ride in some areas. Examples include flex routing of buses, mileage reimbursement, taxi vouchers, senior van pools and subscription bus services. Participants should include those listed in the preceding recommendation, as well as the Maricopa County Human Services Department, the American Red Cross, the Sun City Homeowners Association and the Sun City West Property Owners & Residents Association. *Responsibility: MAG, Maricopa County, Surprise, El Mirage, Youngtown, RPTA, private stakeholders and interest groups.*

D. Need: Park-and-ride capacity is needed near Loop 101.

Option D1: In the short- to mid-term, a regional park-and-ride lot would be developed to serve the eastern portion of the study corridor (vicinity of Grand Avenue/Loop 101) and adjacent areas. The MAG Park-and-Ride plan specifies a site near the intersection of SR 101 and Glendale Avenue in Glendale. A facility at this location would serve future express bus routes

from the Grand Avenue Northwest Corridor and the Arrowhead Towne Center area, as well as carpools. *Responsibility: MAG, ADOT, RPTA, cities*.

E. Need: Bus routes and Dial-a-Ride services will need to meet regional service standards.

Option E1: In the mid-term (5 to 10 year) period, all transit service levels in the Grand Avenue Northwest Corridor would be upgraded to regional standards. These standards, as presented in Exhibit 1 of the Valley Metro Short Range Transit Report for 2001-2005, include bus service frequencies of 15 minutes or less during peak periods, 30 minutes off-peak and Saturday, and 60 minutes on Sunday. Local bus routes are to operate 20 hours per day on weekdays, 19 hours on Saturday and 18 hours on Sunday. There are also standards for route layout and spacing, transfers, passenger stops and bus stop treatments. *Responsibility: Maricopa County, El Mirage, Surprise, Youngtown, RPTA*.

F. Need: Surprise, Sun City, Sun City West and Youngtown will require improved alternatives for local circulation.

Option F1: Existing travel patterns and desires would be evaluated in order to identify circulator bus routes that would connect neighborhoods to key local destinations, activity centers and regional routes. A demonstration project in an area appears particularly promising. To give the service a reasonable chance of success, it should operate frequently (at least twice an hour), throughout the day, and bi-directionally (if the route is an extensive loop). It should also be well marketed locally. Bus stops should be equipped with passenger amenities at key locations. Wherever appropriate, cooperation should be secured from commercial property owners to allow buses to pull into retail centers and medical and social service facilities. A successful demonstration project could lead to implementation of additional routes elsewhere in the corridor. All vehicle specifications must be written with the needs of senior and mobility-challenged residents in mind. *Responsibility: Maricopa County, Surprise, Youngtown, RPTA, local stakeholders and interest groups*.

G. Need: Park-and-ride capacity will be needed in the western portion of the corridor.

Option G1: In the mid- to long-term, a regional park-and-ride lot may be needed to serve the western portion of the study corridor (vicinity of Grand Avenue/Litchfield Road) and adjacent areas. The MAG Park-and-Ride plan specified a site near the intersection of Bell and Dysart Roads in Surprise. A facility at this location could serve future express buses from the Surprise/El Mirage area, as well as carpools. *Responsibility: MAG, RPTA, cities*.

H. Need: Express and/or high-capacity transit may be needed in the future as an integral part of the regional system.

Option H1: In the short- to mid-term, the potential modal options for long-term extension of the regional high-capacity transit system through the Grand Avenue Northwest Corridor would be studied. Working Paper No. 7 identified several such options: Bus Rapid Transit (BRT), Light Rail Transit (LRT) and Commuter Rail. Each of these modes would face significant challenges to implementation in this corridor. Commuter rail would require an agreement with the BNSF Railroad to share a heavily used, predominantly single-track freight line with numerous grade

crossings. MAG's upcoming High Capacity Transit Study will consider modal options for the corridor. *Responsibility: MAG, RPTA, ADOT, BNSF Railroad (for commuter rail).*

As noted in Working Paper No. 7, effective Bus Rapid Transit would require exclusive bus lanes or high-occupancy-vehicle (HOV) lanes on Grand Avenue, to ensure that buses would not be slowed by single-occupant-vehicle traffic. LRT has even more restrictive requirements, in that the tracks would require exclusive use of two-lane equivalents. If the tracks were placed in the median, no left turns would be permitted at unprotected locations for safety reasons. However, the roadway cross-section is limited to six lanes. Dedicating two lanes to bus or light rail transit would reduce the effective capacity of Grand Avenue by approximately one-third.

One way to preserve some of this capacity would be to operate BRT in lanes shared with other HOVs (vehicles with more than one occupant) rather than in exclusive lanes. However, replacing general traffic lanes with HOV lanes on Grand Avenue would raise the following problems and concerns:

- Buses and carpools do not mix as well on arterial streets as on freeways, especially if local buses that stop frequently are included in the traffic mix.

- The travel time benefits to carpoolers may be negligible, especially if the curb lanes are reserved for HOVs, owing to the continued availability of these lanes to vehicles making right turns (to and from the mainline) at driveways and intersections. Ramp merge/diverge movements at grade-separated interchanges could also reduce the travel time advantage of curbside HOV lanes. Median HOV lanes present their own operational problems due to left-turning vehicles weaving across the lanes.

- Police enforcement of HOV restrictions would be complicated by the need to allow general traffic to use the lanes for right turns. This issue currently affects Central and First Avenues between Roosevelt and Van Buren, the only arterial streets in the Phoenix area that have restricted diamond lanes.

- HOVs may be blocked by right-turning vehicles at intersections. Where right-turn lanes exist, safety hazards may result from vehicles weaving across the HOV lane to reach the turn lane.

- Local buses in a curbside HOV lane will hinder non-stop express bus operations. Drivers may not expect to see BRT buses pull out of the HOV lane to pass local buses.

- If HOV lanes are underutilized compared to the general traffic lanes, they not only are perceived as wasteful and inefficient, but also create safety issues. Drivers turning right onto Grand Avenue may perceive the curb lane as mostly empty and fail to watch closely enough for approaching vehicles. This concern is especially pertinent to buses, which require substantial distances for emergency stops when traveling at high speeds.

- Another safety issue arises from drivers making right turns onto the mainline, who may turn directly into the inside lanes instead of merging to the left from the curb HOV lane. These merging maneuvers would impede HOV operations and complicate enforcement.

In sum, Grand Avenue from Loop 101 to Loop 303 does not appear to be a good corridor for HOV lanes. The conclusion that Grand Avenue is not a suitable corridor for HOV lanes is consistent with MAG's HOV System Plan.

4.2 Pedestrians

Within this section needs and options for improving pedestrian facilities in the Grand Avenue Northwest Corridor are identified and discussed. The options are derived from an analysis of the needs described in Working Paper No. 7. They also incorporate the recommendations of the MAG Elderly Mobility Working Group.

The following stated objectives were derived from the agency/community forums and the public meeting to mitigate specific impediments or deficiencies. Objectives of the corridor study that specifically pertain to pedestrian travel include:

- Improve aesthetics of the corridor
- Improve crossings of Grand Avenue and the railroad
- Improve traffic operations at intersections
- Improve safety within the corridor
- Enhance elderly mobility
- Enhance alternative mode travel within the corridor

A. Need: Grand Avenue for the length of the corridor does not have curbs or sidewalks, except for short stretches serving recently developed retail centers on the south side of Grand northwest of Bell Road.

Option A1: A shared use path would be established on the southwest side, linking the communities along Grand Avenue. The path would be wide enough for shared bicycle and pedestrian travel, or approximately 10 feet. It would be landscaped with shade trees, which would improve the aesthetics of the corridor. This route could become part of a loop system to help connect neighborhoods and adjacent communities by modes other than the automobile. *Responsibility: ADOT, cities, Maricopa County.*

Option A2: On intersecting streets, a wider standard walkway for the corridor — 6 feet on collectors and 8 feet on arterials — would be established. The walkway would be detached from the curb by at least 6 feet to establish a buffer from traffic which would help pedestrians to feel safer using the walkways. *Responsibility: cities, Maricopa County.*

B. Need: Most railroad crossings have not been improved for pedestrians. The BNSF Railroad parallels Grand Avenue for the length of the corridor. All intersecting streets cross these tracks, and all the crossings are protected with crossing arms. However, the condition of the walkway surfaces at these crossings varies.

Option B1: Every railroad crossing would be developed to a minimum standard, using paved trackway and 8-foot walkways. ADA accessibility would be achieved for at least one side of

every crossing, and designated as such with appropriate signage. Pedestrian crossing arms would be added in conjunction with vehicle crossing arms. Shaded queuing space would be provided at intersections. *Responsibility: ADOT, cities, Maricopa County, BNSF Railroad.*

C. Need: Community walls block pedestrian movements. Much of the corridor is lined with masonry privacy walls, especially where residences back up to the roadway. This long continuous line of wall can prevent pedestrians from accessing a potential pedestrian corridor.

Option C1: The potential for adding gated connections through these walls between the new shared use path and adjoining neighborhoods would be analyzed. The analysis would determine whether such connections would be acceptable to property owners in these neighborhoods. *Responsibility: Maricopa County, cities, homeowners and their associations, private stakeholders and interest groups.*

D. Need: Channelized right-turn lanes hamper pedestrian movements. Lane configurations on Grand Avenue and intersecting streets, counting dedicated and channelized right turns as well as left turns, can create conflicts between turning cars and crossing pedestrians. A channelized right turn lane can confuse the pedestrian as to when crossing is safe.

Option D1: Existing free flow right turns would be eliminated and the creation of new channelized turn movements would be discouraged. Use of double left turns would be discouraged in favor of the creation of longer left-turn pockets. *Responsibility: ADOT*.

E. Need: Access to planned non-motorized travel routes is not currently provided. The West Valley Recreation and Multimodal Transportation Corridor intersects Grand Avenue along this section. The corridor is planned as an interconnecting trail system, linking several jurisdictions along the Agua Fria and New rivers. There is currently no direct connection between the Grand Avenue Corridor and this system, some of which is located on existing flood control bank access way.

Option E1: ADA-accessible connection points would be provided on all four corners of the Agua Fria River bridge. The pedestrian connections would be within one-fourth mile of the bridge to access neighborhoods. Trailhead opportunities would be developed and designated on either side of the bridge. The connection to the non-motorized transportation corridor would be signed. *Responsibility: ADOT, cities, Maricopa County, MAG.*

F. Need: The long distances between many destinations are difficult for pedestrians. The distances between destinations are well beyond the 5- to 10-minute walk (800 to 1,400 feet) commonly associated with pedestrian areas. Commercial destinations, while common on many intersecting streets, are located relatively far from residential areas. Some commercial areas are not directly connected via a walkway from major adjoining streets to their front doors. The pedestrian often is forced to cross large areas of parking to reach business establishments.

Option F1: The length of pedestrian trips would be reduced by providing neighborhood circulator transit to cover excessive walk distances. *Responsibility: Maricopa County, cities, RPTA.*

Option F2: Land development standards would be created that break up large parking lots with landscaping; provide direct, shaded pedestrian connections from intersections and adjoining walkways to the front of shopping areas; and set maximums for number of parking spaces rather than minimums based on square footage. *Responsibility: cities, Maricopa County, MAG in a technical assistance role.*

G. Need: Walkways have little or no shade. A pedestrian in the desert needs shade in order to make the trip bearable for any distance, especially from May through October. The recommendation for shade in the region is to have 50% of the walkway surface shaded at the hottest time of the year. A lack of shade trees along Grand Avenue and intersecting streets is commonplace.

Option G1: Walkways would be detached from curbs so that trees can be added to shade pedestrians. The best locations for shading in the hottest months of the year would be evaluated and shade trees would be added to achieve 50% shade along existing walkways. This action would also help to meet the need to improve the aesthetics of the corridor. *Responsibility: cities, Maricopa County, homeowner associations*.

H. Need: Existing sidewalks are too narrow and are close to traffic. Most of the walkways in the corridor were built to the minimum MAG standard, which is an attached sidewalk, measuring 5 feet from back of curb to back of walk. Given the traffic volumes, these facilities are inadequate for pedestrians to feel comfortable and safe walking for any distance. The MAG Pedestrian Plan suggests the desired buffer area to address the latent demand, or pent up need, for comfortable pedestrian walkway space.

Option H1: As in A2 above, walkways would be detached from the curb. *Responsibility: cities, Maricopa County.*

I. Need: Wide roadways are difficult to cross. Given the number of lanes for through travel and turning movements, especially on Grand Avenue, intersections have become long distances for pedestrians to cross within the allotted traffic signal timing phase. Given the age of the population in and near this corridor, pedestrians move more slowly than the average and thus create a safety concern.

Option I1: As in D above, wherever possible, streets would be narrowed to decrease the crossing distances for pedestrians. The traffic signal phasing would be evaluated to allow for a longer crossing time for pedestrians. Pedestrian-activated buttons would be installed at ADA-accessible crossings to generate a walk signal during the normal traffic phasing. Installation of countdown walk signals to alert pedestrians to the amount of time they have to cross, as well as auditory signals for visually challenged persons would be considered. Pedestrian refuge areas in the medians, including a curb area extending on either side of the refuge to buffer pedestrians from turning vehicles would be installed. *Responsibility: ADOT, cities, Maricopa County.*

Additional Potential Pedestrian Actions

MAG Pedestrian Plan 2000

Option J: The methodology of the MAG Pedestrian Plan 2000 to further evaluate the latent demand for pedestrian facilities would be incorporated. As a result, pedestrian counts and neighborhood level meetings may be conducted to determine the specific destinations accessed by using Grand Avenue and intersecting streets. *Responsibility: MAG.*

MAG Elderly Mobility Initiative

In 2001, MAG initiated a planning effort to understand how the dramatic increase in the number of senior Americans will affect the region. This initiative and its findings have direct applicability to the Grand Avenue Northwest Corridor because the corridor serves a number of age-restricted communities. Youngtown, Sun City, Sun City West, and Sun City Grand are all centers of retirement-age individuals. A 30-member MAG Working Group has been conducting discussions with community groups region wide to develop a Regional Action Plan on Elderly Mobility that focuses on safety, accessibility, affordability, and independence. The draft recommendations from the Elderly Mobility Action Plan are organized into four overall categories: Infrastructure/Land Use, Alternative Transportation Modes, Older Driver Competency, and Education & Training. Recommendations for Infrastructure and Alternative Modes are the most applicable to the Grand Avenue Northwest study. The following are optional actions specific to infrastructure by which elderly pedestrians can be better served.

Option K1: As part of a review and update to the MAG Pedestrian Area Policies and Design Guidelines, this corridor would be considered as a candidate to be part of a demonstration area for designing and installing such techniques as:

- Elderly/pedestrian-friendly signage
- Turn/refuge islands
- Audible signals at crosswalks
- Improved parking lot design
- Narrow street design *(Responsibility: cities, Maricopa County, MAG, ADOT)*

Option K2: As suggested in F2 above, land use guidelines would be developed to meet the needs of an aging population in the corridor. The guidelines would be an opportunity to apply a regional approach for consistently locating services (retail, medical, social services, and recreation) in proximity to where seniors live. *Responsibility: cities, Maricopa County, MAG in a technical assistance role.*

Option K3: As a follow-up to this study, an on-site review of current infrastructure/land use for the corridor would be conducted and the results incorporated into the transportation review process. *Responsibility: MAG, cities, Maricopa County.*

4.3 Bicycles

The options listed below are intended to meet bicycle needs in the Grand Avenue Northwest Corridor, as identified in Working Paper No. 7.

A. Need: Improved riding conditions for cyclists along the Grand Avenue corridor from SR 101 to Loop 303. (Responsibility: ADOT, cities, Maricopa County.) The following facility types are candidates for consideration:

Option A1: A white stripe on the outside of the curb lanes would be painted to create an edge line buffer zone that may be used by bicyclists. This option requires shoulders or 16-foot wide outside lanes. Both sides of the road need to have the space so that bicycle travel can be provided in both directions. Some use of this option already exists in portions of the corridor especially in the El Mirage and Surprise areas. From SR 101L to 111th Avenue, however, the shoulders outside the edge stripes are generally too narrow for safe use by cyclists.

Option A2: Bike lanes would be provided along Grand Avenue. Bike lanes must be at least 6 feet wide, signed, and provided in both directions. Bike lane striping and signing increase cyclists' confidence that motorists will not stray into their path of travel, and vice versa. Bike lanes are generally preferred over other options by serious bicyclists. The lanes also help identify cycling as a viable mode of transportation. Since Grand Avenue does not and will not have on-street parking, conflicts between cyclists and parked vehicles are not an issue. Increased motor vehicle speeds due to roadway improvements along Grand Avenue could, however, create more hazardous cycling conditions, which could be mitigated by providing greater bike lane width.

Option A3: A 10-foot wide bike path would be provided along Grand Avenue for use by bicyclists and pedestrians as discussed in Pedestrian Option A1. The path would not continue across signalized intersections so that both pedestrians and cyclists would have to use the crosswalks.

Bike paths are on exclusive rights-of-way with minimal cross flow by motor vehicles. According to the *Arizona Bicycle Facilities Planning & Design Guidelines*, bike paths should not be considered a substitute for the street, because many cyclists will find them less convenient than the street, especially for commute and other non-recreational trips.

A bike path, or multi-use path shared with pedestrians, would have the following advantages:

- Minimal conflicts between bicycles and motorized traffic, except at signalized intersections
- Opportunities to integrate landscaping and other amenities, improving the aesthetics of the corridor
- Availability of an alternative to bicycle operation in mixed street traffic
- A direct route connecting the proposed multi-use paths along the Agua Fria and New rivers
- A single path, if wide enough and sufficiently buffered from adjacent streets, can serve both directions of travel

Disadvantages of a bike path include the following:

- Generally not compatible with grade separations
- Not preferred by serious bicyclists due in part to conflicts with pedestrians
- Right-of-way may not be available
- Higher maintenance cost

B. Need: Grade-separated crossings of Grand Avenue and the railroad for pedestrians and bicyclists.

Option B1: All grade-separated crossings of Grand Avenue and the BNSF Railroad would be designed to accommodate bicycles and pedestrians. *Responsibility: ADOT.*

C. Need: A more direct route across Grand between the El Mirage and Surprise CBDs.

Option C1: On-street bike lanes or edge line buffer zones would be provided as part of the El Mirage Road/Thompson Ranch Road connector between Paradise Lane in Surprise and Grand Avenue in El Mirage. This facility would link up with the proposed El Mirage Road bikeway to the north, extending from Paradise Lane to Deer Valley Drive. *Responsibility: cities of El Mirage and Surprise.*

D. Need: Non-motorized trails, including routes along the river beds.

Option D1: The West Valley (New River) Multimodal Transportation Corridor and the West Valley Rivers/Agua Fria Corridor would be developed as non-motorized transportation and recreation corridors with appropriate amenities, including bicycle storage facilities at key locations. The multi-use path along the north edge of Surprise and within the Grand Avenue Northwest Corridor as proposed in the Surprise General Plan 2020 would also be implemented. *Responsibility: MAG, Surprise, Maricopa County (including Flood Control District), ADOT.*

E. Need: Convenient access between the Grand Avenue Northwest Corridor and future off-street paths or trails.

Option E1: The proposed Grand Avenue multi-use path would be directly connected with the West Valley (New River) Multimodal Transportation Corridor, the West Valley Rivers/Agua Fria Corridor, and other off-road transportation/recreation corridors developed in the future. Signage would be provided indicating the connections. *Responsibility: MAG, Maricopa County (including Flood Control District), cities, ADOT.*

F. Need: Bikeway connections between Grand Avenue and other regional facilities.

Option F1: Bikeway planning and development in the corridor would be coordinated with the municipalities of Surprise, El Mirage, Youngtown, Peoria, and with the Maricopa County Department of Transportation. *Responsibility: These jurisdictions and MAG.*

G. Need: A continuous, interconnected bicycle network crossing jurisdictional boundaries.

Option G1: The following on-street bikeways that cross or enter the study corridor, as proposed in relevant studies or plans would be developed:

- Bike lanes or edge line buffer zones on 99th Avenue, Beardsley Road-Olive Avenue (MCDOT Bicycle System Plan)
- Bike lanes or edge line buffer zones on 103rd Avenue, Boswell Boulevard-Grand Avenue (MCDOT Bicycle System Plan)
- Bike lanes on El Mirage Road, Bell Road-Paradise Lane (Surprise General Plan 2020)
- Bike lanes on Dysart Road, Bell Road-Greenway Road (Surprise General Plan 2020)
- Bike lanes or edge line buffer zones on Litchfield Road from Bell Road south (MAG Regional Bicycle Plan)
- Bike lanes on Reems Road, Grand Avenue-Peoria Avenue (Surprise General Plan 2020)
- Bike lanes or edge line buffer zones on Thunderbird Road, Peoria City Limit to 99th Avenue (MCDOT Bicycle System Plan)
- Bike lanes or edge line stripe buffer zones on Waddell Road, Dysart Road-Cotton Lane (MCDOT Bicycle System Plan)
- Bike lanes on Greenway Road, Grand Avenue-Trilby Wash Basin (Surprise General Plan 2020)
- Bike lanes or edge line buffer zones on Bell Road, 99th Avenue-Grand Avenue (MAG Regional Bicycle Plan)
- Edge line buffer zones on Bell Road, Grand Avenue-Sun Valley Parkway (MAG Regional Bicycle Plan)
- Bike lanes on Mountain View Boulevard, Parkview Plaze-Sunrise Boulevard (Surprise General Plan 2020)

Responsibility: Maricopa County, Surprise, El Mirage, Peoria.

H. Need: Physical improvements to many railroad crossings.

Option H1: Every railroad crossing would be brought up to a minimum standard with paved trackway. A bicycle safety audit of grade crossings would be conducted in the corridor and its recommendations would be implemented. (Refer to Pedestrian Need B.) *Responsibility: ADOT, BNSF Railroad, cities, Maricopa County.*

I. Need: Enhanced aesthetics, comfort and amenities for bicyclists in the corridor.

Option I1: See the recommendations under Pedestrian Needs A, F and G.

4.4 Electric Carts

The following options are presented to address specific needs in the Grand Avenue Northwest Corridor, as identified in Working Paper No. 7.

A. Need: A safe and legal route for electric carts between Sun City and Surprise/Sun City West.

Option A1: When a new vehicular route crossing the Agua Fria River between Peoria Avenue and Union Hills Drive is to be built, it would be designed to accommodate carts. *Responsibility: Maricopa County, Surprise, El Mirage, Youngtown.*

B. Need: Additional access between Sun City West and Surprise (including Sun City Grand).

Option B1: As the portion of Surprise southwest of Grand Avenue builds out in coming years, the needs of electric carts would be considered in the design of any new route connecting Surprise with Sun City West across Grand Avenue and the BNSF tracks. *Responsibility: Surprise, Maricopa County, ADOT.*

C. Need: Possible signage to warn of golf cart crossings (e.g., of Grand Avenue).

Option C1: Cart crossing counts would be conducted to determine the number of these vehicles that cross Grand Avenue at signalized intersections in the Sun City, Sun City West and Surprise (Sun City Grand) areas. In cooperation with ADOT, the need for special signage at intersections with high crossing volumes of golf carts would be determined. Such signage may be advisable on Grand Avenue because of its heavy use by long-distance travelers who may not expect to see these smaller, slower-moving vehicles. *Responsibility: ADOT, Maricopa County, cities.*

D. Need: Consideration of educational efforts for cart riders and other road users in areas with heavy electric cart travel.

Option D1: A program would be developed to identify and implement the most appropriate methods of educating motorists regarding their responsibility to safely share the road with slower- or faster-moving vehicles. Techniques similar to those used in motorist/bicyclist programs would be considered; e.g., the "Share the Road" signage campaign recently implemented in Phoenix. *Responsibility: MAG, ADOT, Maricopa County, cities.*

E. Need: Inclusion of cart access, mobility and safety as a key issue in the upcoming MAG Northwest Area Transportation Study.

Option E1: As part of this study effort to be started in the Fall of 2001, the study team would work with representatives of the Sun City Homeowners Association, Sun City West Property Owners & Residents Association and other interested groups. The areas of high cart use would

be identified and a public outreach program would be implemented to gain an understanding of the needs and potential solutions. The results of MCDOT's current golf cart study in Sun City and Sun City West would be reviewed to determine the extent to which these results do or do not apply to incorporated communities in the Northwest Valley. *Responsibility: MAG.*

F. Need: Determination of feasibility of neighborhood electric vehicles (NEV) along off-street corridors.

Option F1: As recommended in the MAG Regional Off-Street System Plan (ROSS), the feasibility and potential applications of NEVs and other non-polluting motorized transportation within off-street corridors would be determined. This action would require careful consideration of the conditions in which such vehicles can safely share off-road transportation facilities with non-motorized users. The principal planned off-road corridors, such as those along the New and Agua Fria rivers, would be evaluated individually. *Responsibility: MAG.*